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Military Aircraft Crash Sites

Archaeological guidance on their significance and future management

ENGLISH HERITAGE

Military aircraft crash sites are an important part of Britain's military and aviation heritage. Predominantly dating from World War II, during which there was a massive expansion in air activity over the UK, they comprise the buried, submerged or surface remains of aircraft, most of which crashed either in combat or training.

Some crash sites are visible, for example as spreads of wreckage within upland environments, or are exposed at low tide. In most cases, however, a scatter of surface debris may mask larger deposits, often buried at great depth. The initial impetus for recoveries comes from both eyewitness reports and documentary research. The debris field can be located by systematic walking across ploughed fields to identify surface concentrations of wreckage or with a magnetometer to assess the extent of buried remains, on the basis of which a point or points of impact can be estimated. Given the potential weight of the components, and their depth, excavation is often carried out using mechanical excavators.

Propeller stubs and reduction gear (above) and remains of a wing section (below) from a Halifax that crashed in the Lake District in 1944. Although much depleted by souvenir hunting and recovery, upland crash sites represent the only places in England where recognisable or substantial remains still lie intact on the surface. *(Photographs by kind permission of Russell E Brown/Lancashire Aircraft Investigation Team)*

Belonging to a period still well within living memory, crash sites have significance for remembrance, commemoration, their cultural value as historic artefacts and the information they contain about both the circumstances of the loss and of the aircraft itself. Crash sites may on occasion also contain human remains, giving them additional value and status as sacred sites and war graves.

It is therefore important that these remains are considered a material matter where they are affected by development proposals and local authority development plan policies and where research- or recovery-led excavations are proposed. Where crash sites are thought to be particularly valuable, for example where they are spatially well-defined and contain the remains of rare aircraft types, such sites may be considered nationally important and should be treated accordingly in line with *Planning Policy Guidance Note 16*. However, all crash sites should be considered of historic significance and the information they contain should not be needlessly destroyed or removed without adequate record.

Loss, retrieval and preservation

In the 1960s, when memories of World War II were still fresh, aviation enthusiasts began to search for the remains of some of the thousands of aircraft lost over southern England, with a particular emphasis upon those destroyed in the summer of 1940 during the Battle of Britain. Early investigations were often cursory, their primary objective being the recovery of highly prized or sought-after artefacts such as the aircraft's control column, and it was not at all unusual for sites to be successively excavated and re-excavated by more than one group or individual over several years. As the accessible Battle of Britain period sites were gradually exhausted, efforts focused on less-easily reached locations, until ultimately attention also turned to crashes from later in World War II.

Documentary sources show us that tens of aircraft were lost on virtually every day of the war. In some cases this may have been due to mechanical failure, in others human error: brought about by fatigue, inexperience or over-confidence. A significant proportion of crashes were the result of damage suffered in combat, whilst the necessity of flying in adverse weather accounted for many more. In exceptional circumstances a pilot might be able to make a forced-landing, saving both the crew and possibly also the aircraft for future use. Often, however, the crew were

forced to take to their parachutes, leaving their aircraft to crash on its own. More commonly still, crew members were unable to escape and remained with the aircraft on impact.

Even during the height of conflict most sites were visited soon after the crash by recovery teams, to remove salvage, human remains, ordnance and, in the case of enemy aircraft, to examine the wreckage for intelligence purposes. The amount of recoverable material was influenced by the size of the aircraft, its speed and angle at impact, the surface into which it impacted, and its location. All of these factors have affected what survives of crash sites today. The period of the crash is also important. World War I aircraft were light, relatively flimsy and, with airframes of wood and 'doped' (varnished) fabric, particularly susceptible to fire. Crashed aircraft from this period tended to remain on the surface and were both simple to recover and more vulnerable to subsequent disturbance. Whilst inter-war period aircraft were slightly larger and more robust, they shared more in design and construction with those of World War I than World War II, in addition to which recovery could be conducted more thoroughly in peacetime than under the pressures of war. During World War II aircraft were much larger, more complex and made extensive use of lightweight but immensely strong alloys. An aircraft from this period hitting the ground at a steep angle and a considerable speed could bury itself many metres deep, leaving large but fragile components such as the wings on the surface and creating a smoking crater, at the bottom of which might be the engine or engines. Above would be the severely compacted airframe, sometimes containing the crew. Salvage crews could easily remove surface wreckage, and where it was known that crew members were unaccounted for strenuous efforts were made to recover their remains, a task made no easier by their depth, the large quantities of aviation fuel and the ever-present risk of fire. Once the crash site had been cleared and made safe the crater would be back-filled before the recovery crew moved on to their next task. As a result of contemporary recovery, even where archaeological traces remain, excavation of lowland World War II crash sites may yield on average only approximately 1 per cent (in weight) of the aircraft. In a very few cases up to 10 per cent may survive, but much of this will be severely distorted and difficult to identify. Most World War I and inter-war crash sites will yield even less.

Because of contemporary recovery operations and subsequent agriculture, survival at most lowland crash sites will often consist of nothing more than a surface scatter of debris. The wreckage in the illustration – all that remains of a Vickers Wellington bomber weighing 12,000kg – represents the result of a careful magnetometry survey followed by systematic recovery. *(Photograph by Mark Evans, Midlands Aircraft Recovery Group)*

Under certain circumstances, preservation in tidal or inter-tidal zones can be exceptional. The cockpit, centre section and Merlin engine of this Hawker Hurricane, a casualty of the Battle of Britain, were recovered from the beach at Walton on the Naze in Essex, and are now on display at the RAF Museum, Hendon.

Submerged crash sites perhaps offer the best potential for the future. The remains of a Wellington bomber which crash-landed in Loch Ness on New Year's Eve 1939 are seen here being recovered in 1985. Carefully restored, the aircraft is now displayed at Brooklands Museum and is one of only two complete Wellingtons known to survive out of a total production run of 11,500. *(Photograph by kind permission of Brooklands Museum)*

Preservation is generally better for crash sites in the uplands, in the inter-tidal zone, or for those completely submerged in rivers, lakes or in the sea. As with more conventional archaeological sites, the inaccessibility of upland crash sites has contributed to their survival, and although much depleted by souvenir hunting and recovery they represent the only places in England where recognisable or substantial remains still lie intact on the surface. The English Channel and the North Sea were the focus of a significant proportion of air activity during the last war, with many hundreds of aircraft being abandoned or crash-landed close to the coastline due to combat damage or technical failures. For example, 234 aircraft of RAF Fighter Command crashed into the sea during the four months of the Battle of Britain, whilst the log for the Skegness lifeboat records that it was called out to aircraft crashes on sixty-one occasions between 1939 and 1945. Given the relatively low speed of impact in many cases, aircraft which crashed at sea were often largely intact as they came to rest on the sea floor and may have remained so, though subsequent damage by trawler nets, salt corrosion and storm action is often severe. The same is true of crash sites in the inter-tidal zone. As with other types of archaeological deposits, preservation within these environments has been generally good, while the majority of the more visible sites have become depleted through souvenir hunting and amateur excavation. It is likely that in submerged and inter-tidal contexts some previously unidentified sites will remain intact and in a good state of preservation.

In general terms preservation is often best in waterlogged contexts, where anaerobic conditions slow the oxidisation of metals and allow the survival of organic materials such as wooden airframe structures, wooden and fabric coverings, parachutes, documents and clothing. Heavy clay soils also aid survival by sealing the debris in pockets of oil or aviation fuel, thus retarding deterioration. Airframes and engines often contain a large amount of aluminium alloy. Although aluminium is in itself relatively resistant to decay, the metal with which it is alloyed has a significant bearing upon its survival.

In many cases investigation may reveal nothing more than small surface scatters of debris. In others, however, substantial pieces including engines, portions of airframes and the equipment and effects of crew members may survive. At a very few sites – chiefly those in inaccessible areas such as mountains, marshland or inter-tidal zones – large components still lie where they fell.

Many crashes involved fatalities. It is estimated that in the region of 80,000 aircrew of all nationalities were killed flying from or over the UK during WWII. Not all of these losses occurred as a result of combat; RAF Bomber Command alone lost 8,000 aircrew in training accidents. The photograph shows a common wartime scene: RAF aircrew from a Midlands-based Operational Training Unit being buried with full military honours *(Photograph by kind permission of the estate of the late Jack Clark)*

Why are crash sites important?

Crash sites are a tangible reminder of the extent of air activity over and around the UK during World War II; a series of battles and raids which are gradually fading from living memory. Given the losses with which they are often associated (sometimes represented by *in situ* human remains), crash sites frequently also provide a focus for commemoration and remembrance. Alongside contemporary documentary records and eye witness accounts, the physical remains also provide a means of reconstructing and in some cases re-assessing our understanding of this aspect of the past.

Crash sites constitute a unique archive of World War II and earlier military aircraft. Many aircraft preserved in museums have either undergone major restoration or are late production models which have been converted to resemble

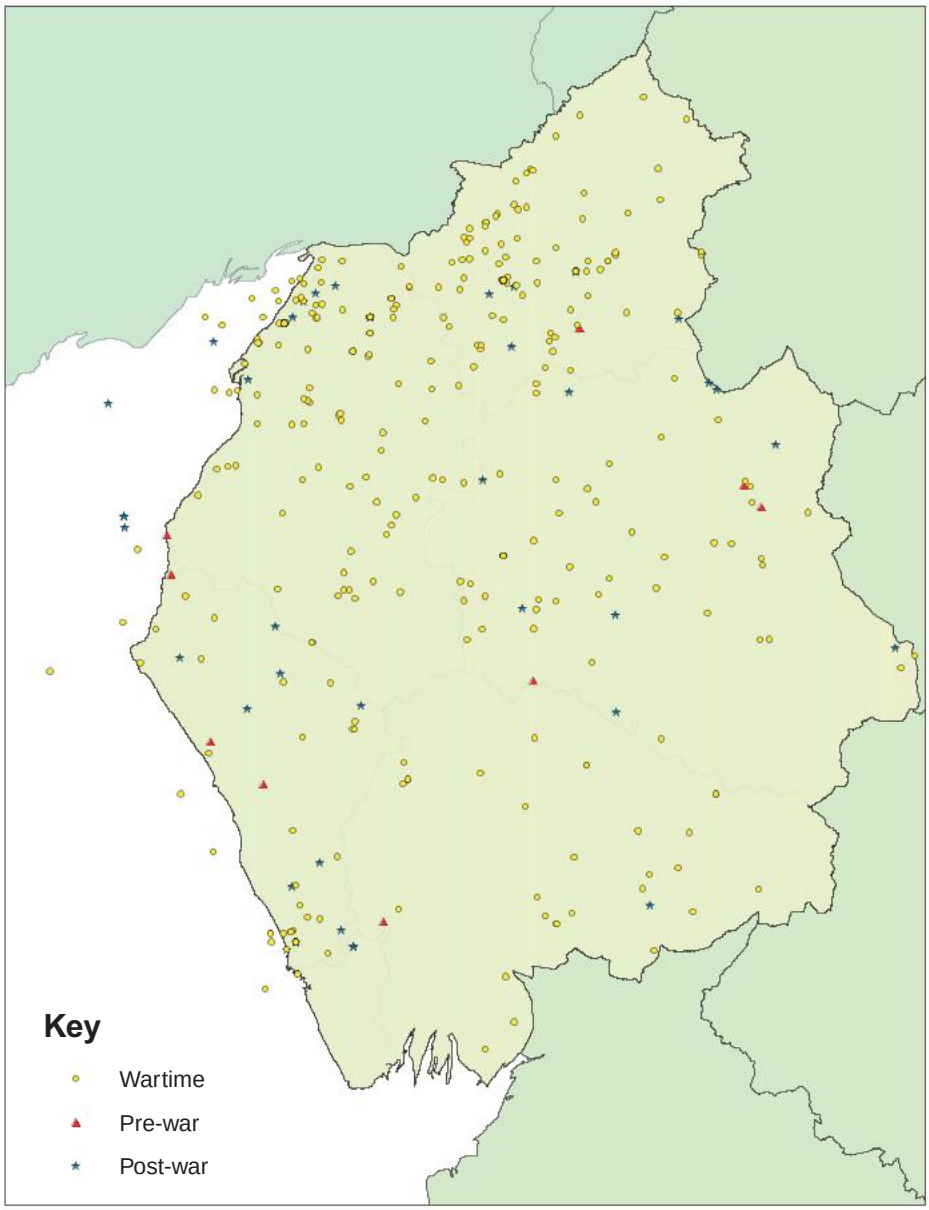
Civilians and an RAF guard gather around the wreckage of a Luftwaffe Messerschmitt 109 fighter which broke up in mid-air and fell on a London street during the Blitz. After being assessed for intelligence purposes, most such wreckage was sent for scrap.

wartime examples. Although the research and skills underlying such restorations are often considerable and serve a valuable purpose in showing what the aircraft may have looked like originally, the remains within crash sites can offer information on manufacturing processes, materials, internal fittings, modifications and even paint finishes that is not available from other sources. Whilst the airframes at most crash sites are fragmentary, significant ancillary items such as engines, electrical, radio or navigational equipment and armament often survive. In some cases these may have a rarity value independent of the aircraft in which they were installed.

The work of English Heritage

Since 1986 English Heritage has been undertaking a national review of England's archaeological resources with the aim of securing their future management – the Monuments Protection Programme (MPP). As part of the MPP and following on from earlier work on 20th-century military remains in England, English Heritage carried out a survey of crash sites in consultation with the Ministry of Defence (MoD).

The first stage of this survey was to estimate the total number of crash sites in England. There are no precise figures available for the number of military aircraft lost over Britain or within its territorial waters during World War I, World War II and the inter-war period. However, whilst records for World War I are particularly fragmentary, those for World War II are better and allow a general estimate to be made. For example, between 1939 and 1945 RAF Bomber Command lost 1,380 aircraft within the UK whilst either outward or inward bound on operational flights and, along with its Operational Training and Heavy Conversion Units, a further 3,986 aircraft in non-operational accidents. The Luftwaffe is known to have lost 1,500 aircraft in and around the UK. American losses are harder to establish because contemporary statistics made no distinction between those aircraft lost in combat over continental Europe or those crashing on their return. However, the UK-based VIIIth Army Air Force reported 1,084 aircraft destroyed through non-operational causes. With the addition of losses for RAF Fighter, Coastal, Army Co-operation and Transport Commands, the Royal Navy's Fleet Air Arm, the Italian Regia Aeronautica, the US IXth Army Air Force, the US Navy and the VIIIth Air Force's operational losses, the combined total figure for World War II might be expected to be considerably in excess of 10,000 aircraft.



Contemporary records provide the primary source of information on the location of crash sites and, although of variable quality, may provide basic data. This distribution plot of known crash sites in Cumbria is not exhaustive, but readily illustrates the size of the resource and the extent of air activity during WWII in comparison to other periods. (Matthew Wright)

Although records relating to actual crash locations are often imprecise, during World War II a significant number clustered along the southern and eastern margins of England where the majority of air activity took place. For example, there are estimated to have been around 1,000 wartime crash sites in Suffolk, compared to the 500 aircraft believed to have crashed in Warwickshire.

Research for the MPP survey indicated that crash sites are likely to contain the largest and most intact remains of twenty-one (22 per cent) of the ninety aircraft types which operated over the UK during World War II, for which no complete examples survive (*see* Tables). Of the British military aircraft used in the UK prior to World War II, sixty-seven (72 per cent) of the ninety-three types are extinct, and crash sites pertaining to any of these aircraft would therefore be particularly valuable. Aircraft in the post-war period have generally been produced in much smaller numbers and have fared better in terms of preservation, with intact examples of all major types surviving. This is because the high cost of producing new aircraft means that existing airframes are more likely to be successively upgraded and modified than replaced, with the result that they remain in service far longer than their predecessors. When aircraft go out of service they tend now to be offered to museums and collectors in comparatively large numbers. Also, since the 1960s lobbying by the aircraft conservation movement has ensured that the MoD has given greater consideration to preservation when disposing of aircraft. Crash sites from this post-war period are therefore considered to have less archaeological merit than those of earlier date.

In exceptional circumstances, normally where the speed and angle of impact caused the wreckage to be buried at much greater depths, lowland crash sites may yield much information. The dark circular patch in the centre of the photograph is the entry hole created by a Supermarine Spitfire hitting the ground vertically at a speed of 400 mph. Although the wings broke off on impact, subsequent excavation recovered the complete fuselage, from engine to tail section, compacted from 9m to less than 1.5m.

Criteria for selection of important sites

English Heritage recognises the importance of sites in terms of survival, rarity or historic importance, and would wish to minimise unnecessary disturbance to examples that meet a combination of the following criteria:

- The crash site includes components of an aircraft of which very few or no known complete examples survive. Examples of the commonplace may also be considered of importance where they survive well and meet one or more of the other criteria.
- The remains are well preserved, and may include key components such as engines, fuselage sections, main planes, undercarriage units and gun turrets. Those crash sites for which individual airframe identities (serial numbers) have been established will be of particular interest.
- The aircraft was associated with significant raids, campaigns or notable individuals.
- There is potential for display or interpretation as historic features within the landscape (for example as upland crash site memorials), or for restoration and display of the crashed aircraft as a rare example of its type.

In general terms, sites meeting any three of these criteria are sufficiently rare in England to be considered of national importance.

Management options

All crashed British aircraft in the UK or its coastal waters are deemed Crown property, all Luftwaffe crash sites are considered captured property surrendered to the Crown, and for US aircraft the MoD acts as the representative of the US government. Under the 1986 Protection of Military Remains Act (PMRA) anyone wishing to excavate or recover a military aircraft is first required to apply for a licence. Licensing for the PMRA is administered by the Central Casualty Section, a part of the Royal Air Force Personnel Management Agency (PMA). Many crash sites still contain live ordnance and, although efforts were made to remove them at the time, a few may also contain the remains of the aircrew. The MoD wishes to minimise the potential risks to excavators and has a moral obligation to the families of dead servicemen to protect their relatives' remains from disturbance, hence applications for a licence to excavate will be refused where there is a risk that such operations may disturb either ordnance or human remains. Even where a licence is granted, however, aircraft wreckage may include items of equipment other than weapons and ammunition that can pose a potential danger, even though they were not regarded as hazardous when the aircraft was lost. For example, the dials of many aircraft instruments were painted with radium-based luminous paints; instruments so treated are now regarded as posing a significant radiological hazard. A note of guidance, available on application

Crash sites are places of loss and commemoration. In 1980 building work for a school-based community centre in Wigston, Leicestershire, uncovered the remains of a Polish Air Force Avro Lancaster which had crashed on the site in 1946, killing the crew. Today, a memorial plaque in the school is the focal point for an annual service conducted by members of Leicester's large Polish community. (Photograph by kind permission of the Polish Air Forces Association)

from the PMA, further explains the procedures and terms for obtaining a licence.

English Heritage fully supports the MoD in its aims, but also recognises the historic importance of the remains. For these reasons, in addition to the terms of the PMRA and depending upon their nature and significance, crash sites could also be dealt with in one of the following ways:

- There is a presumption that nationally important sites should be preserved *in situ*. Scheduling will have a limited and specific role to play, however, due to the difficulties of establishing the extent of buried deposits and because it will offer little protection to smaller – and therefore portable – surface artefacts. Scheduling will only be considered where the extent of the site is known, is demonstrably of national importance, and where English Heritage seeks to control works or damaging activities (perhaps including excavation) through the Scheduled Monument Consent procedures. In the case of larger surface wreckage in upland areas preservation *in situ* may be a viable option, particularly if used in conjunction with interpretation in the form of a guide, trail or signage. (*See Scheduled Monuments: a guide for owners and occupiers*, EH Product code 50403, for an explanation of the role of scheduling).
- In the majority of cases, even for nationally important sites, excavation and recording will be the appropriate response, and close attention should be paid to the methodology adopted. In part this will be determined by the circumstances of the crash and the nature and extent of deposits but, in conjunction with contemporary documentary sources, excavation should aim to recover as much information as possible about the circumstances of the loss. Sampling should take into account the distribution of surface debris in relation to sub-surface remains; together these are strong indicators of the point or points of impact. Records of all excavations and field surveying should routinely be made available to the local Sites and Monuments Record (SMR), and to the National Monuments Record. Excavation of any aircraft crash site should be undertaken in accordance with the Institute of Field Archaeologists' (IFA) *Code of Conduct*, and should comply with its *Standard and guidance for archaeological excavation*. The British Aviation Archaeological Council's (BAAC) *Code of Conduct* offers additional guidance on methods and techniques, and also provides a useful summary of the information that excavation should be expected to obtain.

  Although there is no general database available, advice as to the likelihood of crash sites within a given area can be sought from the BAAC, whose regional members have specialist local knowledge. Basic data on crashes may also be available in local SMRs. In all cases, where the presence of a crash site has been indicated and it is believed that works may disturb it in any way, a licence must be obtained from the PMA before work commences.
- In some cases previously unknown remains will be uncovered during development. In such circumstances there is a strong likelihood of the presence of either ordnance or human remains, and the local police should therefore be informed immediately. If necessary an MoD Explosive Ordnance Disposal Team will be called in to ensure that the site is safe, and until this has been done it is advisable to cease any work in the vicinity. In any excavation where human remains are or are likely to be encountered, whatever the archaeological or historic merits of the crash sites, the feelings of relatives should be respected.

For those wishing to either obtain a licence to excavate or perhaps merely to research in more depth the circumstances leading up to a particular crash, it will be necessary to establish the aircraft type, its serial number, the date of the incident, the unit to which it belonged and the identities of any aircrew involved. There are various sources from which this information may be obtained:

Royal Flying Corps (RFC) and Royal Air Force (RAF) Records relating to the RFC within the UK are fragmentary, but basic data on 'Home Service' losses after October 1916 are preserved at the Public Record Office (PRO) under AIR 1/10,15/1/38 and AIR 1/11,15/1/38. The RAF Museum also holds some 70,000 record cards pertaining to World War I RFC and RAF casualties. RAF aircraft lost in accidents during the inter-war period, World War II and post-war were recorded on Air Ministry Form 1180. Copies of these forms, sorted by type and date, are held on microfilm at the RAF Museum and in many cases also give information on aircrew. The inter-war collection, however, is incomplete. Details of missing aircraft and aircrew can also be found at the PRO in Operational Records Books for squadrons (under AIR 27), stations (AIR 28) and miscellaneous units (AIR 29). Details on losses, usually by aircraft type, command or unit, are also summarised in a variety of specialist publications (*see* Further reading).

Royal Naval Air Service (RNAS) and Fleet Air Arm (FAA) The RAF Museum holds records on early World War I RNAS casualties, whilst incomplete returns for RNAS aircraft losses and casualties between 1917 and 1919 are held at the PRO under AIR 1/105,15/9/280 and AIR 1/106,15/9/282. All individual records relating to aircraft in RNAS/FAA service prior to 1952 were officially destroyed in 1956, but basic FAA squadron operational records for World War II are preserved in the PRO in the ADM 207 series and contain general information on losses. Using a variety of other sources the Records and Research Centre at the Fleet Air Arm Museum, Yeovilton, has compiled a computerised database of FAA losses which is available for public consultation.

Luftwaffe Records of Luftwaffe losses in or around the UK were kept in the Luftwaffe Quartermaster General's daily returns, microfilm copies of which are held at the Imperial War Museum, London. Additional data on crashed Luftwaffe aircraft are to be found at the PRO in the form of RAF Fighter Command combat reports (AIR 50) and extracts from RAF Air Intelligence reports (AIR 22/266, AIR 267, AIR 40/45 and AVIA 15/737). All Luftwaffe losses within the UK have been summarised in a series of publications (*see* Further reading).

United States Army Air Force (USAAF) and United States Navy (USN) USAAF losses were detailed in the daily listings of 'Mishaps', in the weekly or monthly intelligence summaries compiled at Squadron or Group level, in official accident reports and on the individual record cards pertaining to the aircraft, all of which are obtainable on microfilm from the USA via the US Air Force Historical Research Agency. US Navy aircraft accident summaries for the period 1920-69 and aircraft history cards are held on microfilm by the US Naval Historical Center, Naval Aviation Historical Branch. Copies of accident reports and aircraft record cards are also available from a number of commercial organisations within the US.

Information on individual crashes was also recorded at a local level by the Air Raid Precautions, Fire Brigade and Police and is usually held in County Record Offices. Local newspapers can occasionally also be a good source of information, but in wartime were subject to heavy censorship. For fatal crashes involving British or Commonwealth aircrew the registers of the Commonwealth War Graves Commission are also particularly useful.

Table 1 The 21 'extinct' military aircraft in use over the UK in the late 1930s/early 1940s

Manufacturer/Type	Period of Service	Role	Power Plant	Weight (Kg)	Airframe Construction	Total Produced	Notes
Airspeed Horsa	1942–45	Trans, TC	–	3,800	Spruce, plywood covering	3,655	Principal British assault glider of WWII. Used in Sicily, D-Day, Arnhem and the Rhine Crossing. Some surviving sections, but no complete examples
Armstrong Whitworth Albemarle	1941–44	Trans, Tug	2x Bristol Hercules	10,260	Tubular steel frame, spruce and plywood covering	602	First British military aircraft with tricycle undercarriage. Constructed in wood and steel to save on alloys. Used in Sicilian and D-Day airborne campaigns
Armstrong Whitworth Whitley	1937–44	B, MR, Trans	2x AS Tiger or RR Merlin	8,800	Metal monocoque fuselage, fabric covered wings	1,466	First full-production RAF heavy bomber, equipped 4 Group RAF Bomber Command until replaced by Halifax from 1941. Deployed in MR role for the Battle of the Atlantic and later as a glider tug and paratrooper transport
Avro Manchester	1940–42	B,T	2x RR Vulture	14,150	Metal monocoque fuselage, all metal	209	First of new generation of RAF heavy bombers to enter service. Revolutionary engines and extensive use of hydraulics caused constant problems. Important precursor to the Lancaster. Relegated to training June 1942
Blackburn Botha	1940–42	TB, GR, T	2x Bristol Perseus	5,366	All metal	580	Chosen as main torpedo bomber for RAF Coastal Command in 1939. Numerous problems with suitability and handling. Rapidly relegated to training duties
Blackburn Firebrand	1944–53	F, TB	Bristol Centaurus	11,357	All metal	300	FAA carrier-based fighter and torpedo attack aircraft. Rendered obsolete by jets
Brewster Bermuda	1943–45	Tug	Wright Cyclone	4,440	All metal	1000+	Ordered as a land-based dive bomber. 950 were delivered for RAF service, most of which are believed to have served in the UK as target tugs; none are known to have flown operationally
De Havilland Don	1937–40	T, Comms	Gipsy King	?	Tubular metal frame, linen covering	50	Single-engined monoplane trainer and communications aircraft used in small numbers up to the outbreak of WWII
Dornier 17/215	1937–42	B	2x BF	5,210	All metal	1,700	Significant Luftwaffe medium bomber in the Battle of Britain and early Blitz period
Dornier 217	1941–44	B	2x DB 603	9,065	All metal	1,905	Significant Luftwaffe later-war bomber operating over UK
General Aircraft Ltd Hotspur	1941–45	T	–	1,375	Spruce, plywood covering	1061	Principal glider pilot trainer. Tandem seats with room in fuselage for troops. Used purely in training by the Army Air Corps
Handley Page Harrow	1937–45	Trans	2x Bristol Pegasus	10,430	?	100	Transport aircraft which, whilst hurriedly deployed in the Middle East as a bomber, saw limited use in the UK as a transport and communications aircraft with RAF and FAA
Hawker Hector	1937–42	AC, Tug	Napier Dagger	1,694	Tubular steel frame, plywood and canvas covering	178	Interim two-seater biplane, replacement for the Audax. Last biplane to enter RAF service (with 4 Sq RAF in early 1937). Remained with auxiliary squadrons until 1940 with a handful of aircraft carrying out dive bomber attacks against Germans in that year. Relegated for use as glider tug within the UK
Heinkel 177	1944–45	B, MR	2x DB 610	16,800	All metal	1,169	Heavy bomber, made its debut over England in January 1944 during the 'Little Blitz'. Novel engine layout and unreliability caused constant problems
Junkers 86	1936–42	B, GR	2x JJ 207	6,700	All metal	810-1000	High altitude GR and B versions operated by Luftwaffe over southern England 1941–42
Junkers 188	1943–45	B	2x JJ 213 or 2x BMW 801	9,900	All metal	1,100	Operated by Luftwaffe over UK 1944 onwards as a night intruder
Percival Petrel	1939	Comms	2 x DH Gipsy Six	1,588	Tubular metal frame, canvas and metal covering	8	Twin-engined communications aircraft which saw limited use with 24 Sq RAFand 781 Sq FAA
Saunders Roe Lerwick	1939–42	MR	2x Bristol Hercules	5,060	All metal	21	Flying boat used in limited fashion by 422 Sq RCAF in RAF Coastal Command
Short Stirling	1941–46	B, Trans, RCM	4x Bristol Hercules	17,659	All metal	2,374	The first of the RAF's four-engined heavy bombers to enter service. By mid-1943 it had been relegated from the primary bombing role due to its limited service ceiling and heavy losses. Reused as a transport, glider tug and by 100 Grp RAF in the RCM role
Vickers Warwick	1943–46	MR, ASR, Trans	2x Bristol Centaurus	12,700	Aluminium and steel geodetic structure, fabric covering	700	Intended replacement for the Wellington. Used mainly by RAF Coastal Command for ASR and MR duties, also subsequently as a transport
Westland Whirlwind	1940–43	FB	2x RR Peregrine	3,699	All metal	112	Innovative fighter bomber. Suffered engine problems and only ever equipped 2 RAF squadrons, used in support of bombing operations and for attacks on France

Table 2 The ten most common (in terms of surviving examples) military aircraft in use over the UK in the late 1930s/early 1940s

Manufacturer/Type	Period of Service	Role	Power Plant	Weight (Kg)	Airframe Construction	Total Produced	Survivors: Global (UK)	Notes
Avro Anson	1936–68	MR, T	2x AS Cheetah	2,440	Tubular steel, spruce and plywood covering, Bakelite and plywood wings	11,000	30 (16)	Introduced as GR aircraft, later adopted as principal trainer. Only one wartime military version (Mk I) survives. First RAF aircraft with retractable undercarriage
De Havilland Mosquito	1941–50	F, B, NF	2x RR Merlin	6,394	Spruce, plywood and fabric covering	7,781	20 (6)	Significant bomber and multi-role aircraft from 1942. Took part in many famous raids such as attacks on Amiens prison and Gestapo headquarters in Bergen
De Havilland Tiger Moth	1931–47	T	DH Gypsy	525	Tubular steel and spruce, plywood and fabric covering	8,565	400+ (42)	Principal biplane elementary flying trainer in UK and Commonwealth training schools. Adaptation of a civilian design. Many survive
Douglas Dakota/ C-47 Skytrain	1942–50	Tug, Trans, TC	2x PW R1830	7,657	All metal	10,691	550 (16)	Conversion of pre-war civilian airliner type. A total of 1,920 delivered for RAF use and became the principal transport aircraft for this and the US IX AAF. Took part in the D-Day and Operation Market Garden campaigns and saw action in all theatres
Gloster Meteor	1944–61	F	2x RR Welland or RR Derwent	3,995	All metal stressed skin	3,875	47+ (42)	First RAF jet fighter to enter service (July 1944) to counter the V-1 flying bomb. Used extensively post-war. Wartime versions are rare
Hawker Hurricane	1937–45	F, FB	RR Merlin	2,118	Tubular steel and aluminium alloy fuselage frame, light wooden formers, canvas covering. Steel and stressed aluminium alloy wings	14,533	45+ (29)	Most numerous RAF fighter in Battle of Britain, from 1941 relegated to Mediterranean and Far East in fighter bomber and anti-shipping roles. Also adapted as a convoy protection fighter on Russian and Atlantic routes, launched from merchantmen. Served on 17 battlefronts including Battle of France, Norway, BoB, Malta, North Africa, Sicily, Adriatic and Burma campaigns
Miles Magister	1937–45	T	DH Gypsy	583	Spruce and plywood	1,227	14 (8)	Two-seater training and communications aircraft
North American Harvard	1942–56	T	PW Wasp or A1340	2,549	Steel frame fuselage, fabric and plywood, later alloy, covering	9,577+	400 (23)	5,125 delivered for RAF and Commonwealth usage as trainers. Equipped many flying training schools in the UK and overseas
North American P-51 Mustang	1942–47	F, FB, AC	Allison 1710 or RR Merlin	2,858	All metal	15,586	257 (8)	2,517 delivered for RAF use. Initially ordered as a fighter, mostly used by 2 Tactical Air Force in the fighter bomber/Army Co-operation role. Principal USAAF fighter in Europe from 1943–44. Operated by VIII AAF as long range fighter and by IX AAF in tactical role
Supermarine Spitfire/Seafire	1938–50	F	RR Merlin or RR Griffon	2,545	All aluminium monocoque fuselage and wings	22,928	300+ (59)	Principal RAF day fighter from early 1941 until the end of the war. Operated in all theatres and in all major campaigns and also adapted for use on aircraft carriers as the Seafire

Key to tables

Period of service Total period of service with respective air force (as opposed to period of usage over the UK – see Notes column)

Role Military role in which the aircraft was utilised (often not the role for which it was designed):
AC = Army Co-operation, **ASR** = Air Sea Rescue, **B** = Bomber, **Comms** = Communications, **F** = Fighter, **FB** = Fighter Bomber, **GR** = General Reconnaissance, **MR**= Maritime Reconnaissance, **NF** = Night Fighter, **RCM** = Radio Countermeasures, **Recon** = Reconnaissance, **TB** = Torpedo Bomber, **T** = Trainer, **TC** = Troop Carrier, **Trans** = Transport, **Tug** = Glider/Target Tug Power plant **AS** = Armstrong Siddley, **BF** = Bramo Fafnir, **DB** = Daimler Benz, **DH** = De Havilland, **JJ** = Junkers Jumo, **PW** = Pratt and Whitney, **RR** = Rolls Royce

Weight Total weight of airframe and engines, unloaded; intended to give general indication of relative size

Airframe construction Basic data on construction and major materials, where known

Survivors Number of complete airframes (ie more than 66% intact) known to survive globally (inclusive of UK).
Figure in brackets = number surviving within UK. Global figures represent estimates; UK figures are accurate and based upon 16th edition of *Wrecks and Relics* (Ellis 1998)

Notes General information on background, importance and currency (ie use within UK)

What the sources tell us: the Handley Page Hampden

Documentary sources can combine to provide numerical data relating to particular types of aircraft. For example, the Handley Page Hampden entered RAF service in 1938 as a heavy bomber. Before 1942, when the type was removed from front line use with Bomber Command and relegated to training, 424 (25.2 per cent) of the 1680 produced were lost in combat over Europe and the North Sea, while the Air Ministry form 1180s record 997 accidents (affecting 59.3 per cent of the aircraft produced) within the UK, of which 631 resulted in the loss of the aircraft. A further 159 aircraft (9.5 per cent) were scrapped. Further analysis of these records suggests that 326 of recorded accidents – representing 19.4 per cent of the Hampdens produced – might be expected to have left archaeological traces (that is, they are described as having crashed rather than force-landed, since the latter often resulted in the complete recovery of the aircraft and frequently its repair to flying condition). A brief analysis of statistics relating to other British aircraft types suggests that the figures for the Hampden are broadly representative.

Further information

English Heritage
23 Savile Row
London
W1S 2ET
Tel: 020 7973 3000

English Heritage is the government's statutory advisor on archaeology and the management of the historic environment in England. Further information can be obtained from the address above, or from:

National Monuments Record Centre
Kemble Drive
Swindon
SN2 2GZ
Tel: 01793 414600

We also have nine regional teams, each of which includes archaeologists. In addition to the team at the London address, they can be contacted at:

South East
Eastgate Court
195–205 High Street
Guildford GU1 3EH
Telephone: 01483 252000

South West
29/30 Queen Square
Bristol BS1 4ND
Telephone: 0117 975 0700

East of England
Brooklands House
24 Brooklands Avenue
Cambridge CB2 2BU
Telephone: 01223 582700

West Midlands
112 Colmore Row
Birmingham B3 3AG
Telephone: 0121 625 6820

East Midlands
44 Derngate
Northampton NN1 1UH
Telephone: 01604 735400

North East
Bessie Surtees House
41–44 Sandhill
Newcastle-upon-Tyne NE1 3JF
Telephone: 0191 261 1585

North West
Suites 3.3 and 3.4
Canada House
3 Chepstow Street
Manchester M1 5FW
Telephone: 0161 242 1400

Yorkshire
37 Tanner Row
York YO1 6WP
Telephone: 01904 601901

Website: www.english-heritage.org.uk

The Association of Local Government Archaeological Officers (ALGAO) represents local authorities that maintain archaeological services across England. A list of members is available on request from:

ALGAO
c/o Heritage Consultation Group
Planning Division
Essex County Council
County Hall
Chelmsford CM1 1LF
Telephone: 01245 437676
Website: www.algao.org.uk

The British Aviation Archaeological Council, founded in 1978, represents amateur aviation archaeological groups within the UK. The Council produces a newsletter through which groups are able to exchange views, news and information and has produced a voluntary *Code of Conduct*. The aims of the Council are to improve and maintain standards within aviation archaeology, to provide advice to member groups, and to promote the preservation of aircraft relics and associated artefacts.

BAAC Honorary Secretary
Spring View
Kenilworth
Warwickshire
CV8 2JS
Email: baac@couplandbell.com

The Commonwealth War Graves Commission is charged with managing the graves and memorials of the 1,700,000 men and women of the Commonwealth forces who died in World War I and other 20th-century conflicts. Amongst the services it provides is a searchable online database of casualties.

The Commonwealth War Graves Commission
2 Marlow Road
Maidenhead
Berkshire
SL6 7DX
Telephone: 01628 634221
Website: www.cwgc.org

The Fleet Air Arm Museum holds a wide range of documents from official and private sources, related to British Naval Aviation. Researchers may conduct their enquiries either in person or by post. Visitors should contact the Centre in advance to book an appointment.

Records & Research Centre
Fleet Air Arm Museum
Box D6
RNAS Yeovilton
Near Ilchester
Somerset
BA22 8HT
Telephone: 01935 840565
Fax: 01935 842630
Website: www.fleetairarm.com
Email: enquiries@fleetairarm.com

The Institute of Field Archaeologists (IFA) is the professional body for archaeologists and promotes best practice in archaeology. Its *Code of Conduct,* by-laws and standards and guidance documents set out requirements and advice relating to archaeological work and apply to aviation archaeology.

Institute of Field Archaeologists
University of Reading
2 Earley Gate
PO Box 239
Reading RG6 6AU
Telephone: 0118 931 6446
Fax: 0118 931 6448
Website: www.archaeologists.net
Email: admin@archaeologists.net

The Public Record Office (PRO) is the national archive of the United Kingdom, bringing together and preserving the records of central government and making them available to all who wish to consult them. A database of PRO holdings can be consulted via their online catalogue, PROCAT.

Public Record Office
Ruskin Avenue
Kew
Richmond
Surrey
TW9 4DU
Telephone: 020 8876 3444
Fax: 020 8392 5286
Website: www.pro.gov.uk
Email: enquiry@pro.gov.uk

The Royal Air Force Museum, opened in 1972, is Britain's only national museum dedicated solely to aviation. The Department of Research and Information Services is responsible for the Museum's Archive and Library collections which are available to the public. Access is by appointment only and arrangements to view material should be made well in advance of proposed visits.

Department of Research & Information Services
Royal Air Force Museum
Grahame Park Way
Hendon
London
NW9 5LL
Telephone: 020 8205 2266
Fax: 020 8200 1751
Website: www.rafmuseum.org.uk
Email: info@rafmuseum.com

The Royal Air Force Personnel Management Agency is responsible for the licensing of aircraft excavations. Information on licensing and the procedure for applications is contained in the leaflet *Notes for Guidance of Excavators,* which is available from the following address:

Ministry of Defence
PMA (CS) 1b1a (RAF)
RAF Innsworth
Gloucestershire
GL3 1EZ
Website: www.raf.mod.uk/ptc/pmacasualty.html

The US Naval Historical Center, Naval Aviation History Branch deals with subject matter relating to US Naval Aviation from 1911 to the present.

Naval Historical Center
Naval Aviation History Branch
805 Kidder Breese SE
Washington Navy Yard
Washington DC 20374-5060
USA
Website:
www.history.navy.mil/branches/nhcorg4.htm

The US Air Force Historical Research Agency holds over 70,000,000 pages devoted to the history of the service. Except for documents that are classified, the Agency's collection is open to the public and visitors are welcome. The Agency's collection is also recorded on microfilm, with copies deposited at the Air Force History Support Office, Bolling Air Force Base (USA).

Air Force Historical Research Agency
600 Chennault Circle
Bldg 1405
Maxwell AFB
Alabama 36112-6424
USA
Telephone: +1 334 953-2395
Website: www.maxwell.af.mil/au/afhra/
Email: AFHRANEWS@maxwell.af.mil

The US Air Force History Support Office can be contact by email (via the website address below) or by post. Those wishing to visit should email or telephone beforehand to make an appointment.

Air Force History Support Office
AFHSO/HOS
Reference and Analysis Division
200 McChord Street
Box 94
Bolling AFB
DC 20332-1111
USA
Telephone: +1 202 404 2261
Website: www.airforcehistory.hq.af.mil/

Further reading

Information on the background to English Heritage's approach to the management of crash sites and other 20th-century military remains is given in:

Dobinson, C, Lake, J and Schofield, A J 1997 'Monuments of war: defining England's 20th-century defence heritage'. *Antiquity* **71**(272), 288-99

English Heritage 1998 *Monuments of War: The Evaluation, Recording and Management of Twentieth-Century Military Sites*. London: English Heritage

English Heritage 2000 *Twentieth-Century Military Sites*. London: English Heritage

Holyoak, V 2001 'Airfields as battlefields, aircraft as an archaeological resource: British military aviation in the first half of the 20th century' *in* Freeman, P W M and Pollard, A (eds), *Fields of Conflict: Progress and Prospect in Battlefield Archaeology*. (Brit Archaeol Rep Internat Ser 958). Oxford: Brit Archaeol Rep, 253-64

Holyoak, V 2002 'Out of the blue: assessing military aircraft crash sites in England, 1912–1945'. *Antiquity* **76**(293), 657–63

Lake, J 2002 'Historic airfields: evaluation and conservation' *in* Schofield, J, Johnson, W G and Beck, C M (eds) *Matériel Culture: The Archaeology of Twentieth-Century Conflict*. (One World Archaeology **44**). London: Routledge, 172-88

The background to aviation archaeology and accounts of some amateur excavations are covered in:

de la Bédoyère, G 2000 *Battles over Britain – The Archaeology of the Air War*. Stroud: Tempus.

McLachlan, I 1989 *Final Flights – Dramatic Wartime Incidents Revealed by Aviation Archaeology*. Sparkford: Patrick Stevens

Information on crash site locations is available in many publications, of which the following are examples:

Chorley, W R 1998 *Royal Air Force Bomber Command Losses of the Second World War, Vol. 6: Aircraft and Crew Losses 1945*. Leicester: Midland Publications

Cummings, C nd *Final Landings: A Summary of RAF Aircraft and Combat Losses 1946–9*. Yelvertoft: Nimbus Publishing

Franks, N L R 1997 *Royal Air Force Fighter Command Losses of the Second World War, Vol. 1: Operational Losses, Aircraft and Crews 1939–41*. Leicester: Midland Publications

Ramsey, W (ed) 1989 *The Battle of Britain Then and Now*. Mk V. London: Battle of Britain Prints International

Ramsey, W (ed) 1987 *The Blitz Then and Now, Vol 1*. London: Battle of Britain Prints International

Smith, D J 1997 *High Ground Wrecks and Relics – Aircraft Hulks on the Mountains of the UK and Ireland*. Leicester: Midland Publications

Contemporary documentary sources in the Public Record Office are discussed in:

Fowler, S *et al* 1994 *RAF Records in the PRO*. London: Public Record Office

Further copies of this leaflet can be obtained from:

English Heritage
Customer Services Department
PO Box 569
Swindon
SN2 2YP
Telephone: 0870 333 1181
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Cover image: The wreckage of a German Junkers 88 A-6 bomber, shot down over Lostock Gralam, Cheshire, at 23.45 hours on 3 May 1941, by 256 Squadron RNZAF *(Hu 72709 photograph courtesy of the Imperial War Museum, London)*

Below: The upside-down wreckage of Wellington LP981, which crashed into the sea off Fleetwood, Lancashire, in April 1945, killing five of its seven crew *(Picture courtesy of The Gazette, Blackpool)*

ENGLISH HERITAGE

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Appendix 1.1: Aircraft utilised by the RFC, RNAS, RAF and US Navy within the UK 1912-18

Manufacturer/Type	Period of Service	Role	Power Plant	Weight (Kg)	Airframe construction	Total Produced	Survivors: Global (UK)	Notes
AD Flying Boat	1917-	MR	Hispano-Suiza	1,512	Wooden hull and frame, linen covering	29	0 (0)	Two-seat patrol flying boat in RNAS service from 1917.
Airco DH 1	1915-17	F	Renault	729	Wooden frame, linen covering	173	0 (0)	Escort and patrol fighter, single-seat pusher type. Used in UK in Home Defence role until superseded in 1917.
Airco DH 2	1915-17	F	Gnome	428	Wooden frame, linen covering	400	1 (1)	Pusher type which equipped RFC's first single-seat fighter squadron in 1916. Short term success in dealing with new Fokkers but was withdrawn from service in mid-1917.
Airco DH 4	1917-19	B, Recon	RR Eagle or RAF 3a	913	Wooden frame, linen covering	1,449	0 (0)	Two-seat tractor biplane. The DH 4 was the first aircraft designed specifically for day bombing, and considered to be best single-engine day bomber of WWI. Served with both the RFC and the RNAS, in the case of the latter from Redcar and Yarmouth in the anti-Zeppelin role.
Airco DH 5	1917-18	F	Le Rhone	454	Wooden frame, linen covering	550	0 (0)	Attempt to give a tractor type fighter a good forward view. Unpleasant flying characteristics and short service career.
Airco DH 6	1916-19	T, MR	RAF 1a, Renault or Curtis OX-5	663	Wooden frame, linen covering	2,282	0 (0)	Designed as a trainer. From 1918 the Avro 504 became the standard training aircraft and the DH 6 was used to equip 34 RNAS flights around the UK's coast in the MR and anti-submarine role, although with little success.
Airco DH 9	1918-19	B	BHP or AS Puma	996	Wooden frame, linen covering	3,204	1 (1)	Development of the DH4 which suffered engine reliability problems, with consequent heavy losses. Utilised in the UK by the RNAS and RAF for coastal patrols in the anti-submarine and anti-zeppelin roles.
Armstrong Whitworth FK3	1915-16	T	RAF Ia	?	Wooden frame, linen covering	500	0 (0)	Under powered two-seat biplane which was primarily used for training in the UK.
Armstrong Whitworth FK 8	1916-19	B	Beardmore	764	Wooden frame, linen covering	588	0 (0)	Two-seat tractor which was the most widely used reconnaissance aircraft of 1917-18, equipping nine RFC squadrons.
Armstrong Whitworth FK 10	1916-1918	F, B	Le Rhone, Clerget	559	Wooden frame, linen covering	8	0 (0)	Two-seat quadruplane built for the RNAS, most of which had been scrapped by the end of the war.
Avro 500	1913-15	T	Gnome	420	Wooden frame, linen covering	?	0 (0)	Two-seat tractor biplane produced in small numbers and used by RFC and RNAS as a trainer.
Avro 503	1913-14	T	Gnome	420	Wooden frame, linen	?	0 (0)	Two-seat training seaplane, a few of which delivered to RNAS before the war.

					covering			
Avro 504	1914-33	F,T	Le Rhone, Clerget or Gnome	420	Wooden frame, linen covering	7,948	8 (5)	Important two-seat tractor biplane initially used by RFC for reconnaissance and by the RNAS as a bomber. First aircraft shot down by the Germans. Hurriedly converted to single-seat Home Defence fighter to counter Zeppelin raids. Later relegated to training.
Beardmore WB III	1918-19	F	Le Rhone or Clerget	404	Wooden frame, linen covering	100	0 (0)	Single-seat carrier-based scout, a derivative of the Sopwith Pup. An early attempt to build an aircraft exclusively for carrier-borne operations. Had folding wings and retractable undercarriage for easier storage. By October 1918 55 were in service.
Blackburn Kangaroo	1918-19	B	2 x RR Falcon	2,401	Wooden frame, linen covering	16	0 (0)	Land-based biplane anti-submarine bomber with crew of four. Used with some success from August 1918 by 246 Sq RAF flying from Seaton Carew who destroyed one U-Boat and damaged four others.
Bleriot XI / Parasol	1911-15	F	Gnome	348	Wooden frame, linen covering	?	0 (0)	The Type XI and a developed version known as the Bleriot Parasol, used in limited numbers by the RFC and by the RNAS.
Bristol Boxkite	1912-15	F	Gnome	522	Wooden frame, linen covering	66	0 (0)	Two-seat pusher biplane trainer in use with the RFC from 1912 and subsequently with the RNAS until mid-1915 at the Eastbourne, Eastchurch and Hendon. First design of the British and Colonial Aeroplane Company (Bristol), the prototype flew in July 1910.
Bristol F2 Fighter	1917-32	FB	RR Falcon	877	Wooden frame, linen covering	4,470	5 (5)	Highly successful two-seat biplane fighter and reconnaissance aircraft, with both forward and rearward firing machine guns. Designed as a replacement for the BE 2, it entered front line service with the RFC in mid 1917 and remained with the RAF until 1932.
Bristol Scout	1914-16	F	Le Rhone, Clerget or Gnome	340	Wooden frame, linen covering	371	2 (2)	Single-seat biplane fighter, in 1916 the Scout was the first British aircraft to be fitted with a synchronised forward firing machine gun to see action. However, it was already outclassed in terms of performance and reverted to experimental use. Utilised by both the RFC and the RNAS. Also the first aircraft with a wheeled undercarriage to take off from a carrier.
Bristol TB 8	1914-16	F	Le Rhone or Gnome	699	Wooden frame, linen covering	51	0 (0)	Two-seat tractor biplane initially intended for the RFC but rejected by them and utilised instead by the RNAS for Home Defence duties during the early part of the war.
Caudron GIII	1913-16	T	Le Rhone, Gnome or Anzani	850	Wooden frame, linen covering	?	0 (0)	Key French designed and manufactured two-seat sesquiplane which, together with subsequent developments, equipped 40 French units but which was used in the UK as a trainer by the RNAS (124 delivered), the RFC and the US Army Air Service (192 delivered).
Caudron GIV	1916-17	B	2 x Le Rhone or Anzani	850	Wooden frame, linen covering	?	0 (0)	Twin-engine, two-seat long range bomber, 55 of which were delivered to the RNAS for long range bombing duties, operating with 4 and 5 Wings at Petit Synthe. Replaced by the Handley Page 0/100.

Curtiss H4	1914-18	MR	2 x Curtiss OX-5, Anzani or Clerget	1,360	Wooden hull and frame, linen covering	?	0 (0)	Twin-engine four-seat biplane flying boat, built under licence in the UK. Known as the `Small America' to distinguish it from the larger H12 later taken into service, 64 of this type were operated by the RNAS from Felixstowe and Killingholme. Suffered many problems, but made important contribution to flying boat development.
Curtiss H12	1917-19	MR	2 x RR Eagle	3,315	Wooden hull and frame, linen covering	?	0 (0)	Twin-engine four-seat biplane flying boat, development of the H4. Known as the `Large America', utilised by the RNAS for anti-submarine and anti-zeppelin patrols flying from Killingholme, Yarmouth and Felixstowe. Claimed first zeppelin shot down by a flying boat.
Curtiss H16	1918-19	MR	2 x RR Eagle	3,346	Wooden hull and frame, linen covering	?	0 (0)	Twin-engine four-seat biplane flying boat, larger developed version of the H12. Approximately 75 were ordered for the RAF, operating from Killingholme and Yarmouth in the anti-submarine role. A further 50 aircraft were flown in the UK by the US Navy, again operating from Killingholme.
Curtiss R2/R4	1915-18	T	Curtiss XV	?	Wooden frame, linen covering	?	0 (0)	Intended for use in the reconnaissance role, 100 were ordered for RNAS service in 1915. The aircraft proved to be under powered and was relegated to armament training.
Curtiss JN3	1915-18	T	Curtiss OX5	?	Wooden frame, linen covering	?	0 (0)	A total of 97 of this US aircraft were delivered to the RNAS for use in the training role.
Curtiss JN4	1917-18	T	Curtiss OX5	800	Wooden frame, linen covering	?	0 (?30)	The most famous US training aircraft of the war and inter-wars period, some 80 `Jennys' were delivered to the RNAS for training duties and 100 served with the RFC.
Fairey III	1918-35	F	Maori II or RR Eagle	1,476	Wooden frame, linen covering	486	1 (1)	Two-seat biplane reconnaissance aircraft (RAF IIIA land plane) and bomber (RNAS IIIB seaplane). Saw limited service before the end of WWI. Post war IIID had either wheels or floats and served with both the RAF and FAA, carrying out long endurance flights.
Fairey Campania	1918-19	MR	RR I, IV or Maori	1,693	Wooden frame, linen covering	40	0 (0)	Two-seat coastal patrol or carrier-borne reconnaissance seaplane. First aeroplane designed for use on board a carrier. Operated from seaplane stations at Calshot, Dundee and Portland.
Fairey Hamble Baby	1917-18	MR	Clerget	630	Wooden frame, linen covering	180	0 (0)	Single-seat anti-submarine patrol seaplane. Derivative of the Sopwith Baby, reworked by Fairey who introduced for the first time trailing edge flaps to increase wing lift. Used by RNAS during 1917-18 operating from coastal stations in the UK and abroad.
FBA Flying Boat	1914-18	T	?	?	Wooden hull and frame, linen covering	?	0 (0)	Small two-seat flying boat, 116 of which were delivered to the RNAS for training duties.
Felixstowe F2	1918-23	F, MR	2 x RR Eagle VIII	3,431	Wooden hull and frame, linen covering	249	1 (1)	Redesign of the US Curtis H4 which enjoyed immense success against U Boats and Zeppelins in the North Sea.
Farman MF7 and MF11	1913-16	Recon , B, T	Renault or Lorraine	652	Wooden frame, linen covering	?	0 (0)	Introduced to RFC and RNAS service in 1913, the MF7 was known as the `Longhorn' because of its landing skids and the MF11 (Type 1914) as the `Shorthorn'. Used initially in the reconnaissance role, both were rapidly relegated to training.

Farman MF20	1914-1916	Recon, B, T	Gnome	372	Wooden frame, linen covering	?	0 (0)	A two-seat land or sea plane which equipped the RNAS in small numbers, flying from Eastchurch initially and then from Belgium and in the Dardanelles.
Farman F40	1915-16	F	Renault	?	Wooden frame, linen covering	?	0 (0)	A single-seat pusher, 50 of this type were delivered for RNAS service, some operating from coastal air stations in the UK.
Grahame-White XV	1914-16	T	Le Rhone or Gnome	?	Wooden frame, linen covering	80	0 (0)	Two-seat pusher biplane, 80 of which were used by the RNAS as a trainer during early part of war, mostly flying from Chingford.
Handley Page 0/100	1916-18	B	2 x RR Eagle	3,772	Wooden frame, linen covering	46	0 (0)	First successful night heavy bomber, having suffered initial heavy losses in daylight role. Three seat biplane with folding wings to enable it to fit into front line hangars. Served with the RNAS and later the RAF.
Handley Page 0/400	1918-21	B	2 x RR Eagle	3,864	Wooden frame, linen covering	554	0 (0)	Development of 0/100, became standard equipment with the Independent Force, the strategic bombing arm of the newly-formed RAF.
Handley Page V/1500	1918-20	B	4 x RR Eagle	7, 368	Wooden frame, linen covering	90	0 (0)	Largest RAF night bomber of WWI, with a crew of up to 7. Aircraft of 166 Sq Bircham Newton were waiting to take off to bomb Berlin when the Armistice was signed.
Martinsyde G.100 / G.102 Elephant	1916-18	F, B	Beardmore	815	Wooden frame, linen covering	271	0 (0)	Initially conceived as long range single-seat biplane fighter. Weight and poor manoeuvrability saw the G.100 (of which 100 were built) relegated to use as light bomber and ground attack aircraft. Subsequent development, the G.102 `Elephant' (of which 171 built) used in similar role, and as long range escort.
Martinsyde F1	1917	F	RR	?	Wooden frame, linen covering	?	0 (0)	Two-seat biplane fighter used experimentally as a Home Defence fighter by the RFC mounting twin machine guns. Stable and with good performance, it did not go into production.
Martinsyde F3	1918	F	Hispano-Suiza	?	Wooden frame, linen covering	6	0 (0)	Single-seat biplane fighter, 4 of 6 produced serving in Home Defence role in 1918. Rapidly developed into the F4 Buzzard.
Martinsyde F4 Buzzard	1918-19	F, Comms	Hispano-Suiza	?	Wooden frame, linen covering	65	0 (0)	Single-seat biplane, fastest Allied fighter of WWI, although reached squadrons too late to see active service. Used as high speed communications aircraft, the Sopwith Snipe becoming instead the standard post-war fighter.
Martinsyde S1 Scout	1915-16	F	Gnome	?	Wooden frame, linen covering	60	0 (0)	Single-seat tractor type biplane, saw approximately 6 months service on Western Front with RFC before being relegated to training duties. Initially intended for use in Home Defence role, it was also found inadequate for these duties.
Morane Saulnier N	1914-15	F	Le Rhone	444	Wooden frame, linen covering	49	0 (0)	Single-seat monoplane fighter which equipped four squadrons of the RFC.
Nieuport 12 Two-seat	1915-16	F, Recon, B	Clerget or Beardmore	550	Wooden frame, linen covering	?	0 (0)	Two-seat biplane, initially purchased from the French but then subsequently manufactured under licence in the UK. Equipped both the RNAS and the RFC.
Nieuport 11/17/24	1915-17	F	Le Rhone	375	Wooden frame, linen	?	3 (1)	French-built Single-seat fighting scouts, successive types of

Scouts					covering			which equipped the RNAS, mostly operating on the Western Front, but also in small numbers from Eastchurch.
Norman Thompson NT 2B	1917-19	T	Hispano-Suiza, Beardmore or Sunbeam Arab	1,200	Wooden frame and hull, linen covering	79+	0 (0)	Two-seat flying boat trainer which operated with the RNAS from Calshot, Lee-on-Solent and Felixstowe. Still in service at the end of the war.
Norman Thompson NT 4	1916-18	MR	2 x Hispano-Suiza	2,078	Wooden frame and hull, linen covering	50	0 (0)	Four-seat anti-submarine flying boat used by the RNAS, operating from Calshot, Cattewater, Dundee, Felixstowe, Invergordon, Killingholme and Scapa Flow.
Parnall Hamble Baby	1915-17?	T	?	?	Wooden frame, linen covering	?	0 (0)	Land plane conversion of the Hamble Baby seaplane, 74 of which were used b the RNAS in the training role.
Royal Aircraft Factory BE2	1914-19	Recon	Renault or RAF Ia	579	Wooden frame, linen covering	3,241	1 (1)	Mainstay RFC two-seat tractor type, the first to see mass production. Used from outbreak of WWI. Used as night fighters by RFC Home Defence units against the Zeppelin.
Royal Aircraft Factory BE8	1913-16	B, Recon	Gnome	?	Wooden frame, linen covering	55	0 (0)	Two-seat tractor type, initially used as a scout and subsequently as a trainer, and in the Spring of 1915 as a light bomber. Known as `The Bloater'.
Royal Aircraft Factory BE 12	1916-18	FB	RAF 4a	740	Wooden frame, linen covering	468	0 (0)	Adaptation of BE2, single-seat fighter which saw limited service in 1916 before being relegated to the role of light bomber.
Royal Aircraft Factory FE 2	1914-18	FB	Beardmore or RR Eagle	936	Wooden frame, linen covering	2,190	1 (1)	Highly successful two-seat pusher type which saw front line service in France between 1915-18, first as a fighter and later in the night bomber and ground attack role.
Royal Aircraft Factory FE 8	1915-17	F	Gnome	405	Wooden frame, linen covering	182	0 (0)	Single-seat pusher type, outdated on entry to front line service and soon relegated.
RE 5	1914-15	B, Recon	Austro-Daimler or Beardmore	?	Wooden frame, linen covering	24	0 (0)	Two-seat tractor type, first of the RE (Reconnaissance Experimental) types to reach full production. Served almost exclusively with the RFC.
RE 7	1915-16	B, Recon	Beardmore	1,038	Wooden frame, linen covering	250	0 (0)	Two-seat tractor type, conceived as day bomber. Served with the RFC, although weak defensive armament saw it quickly superseded.
RE 8	1916-20	B, Recon	RAF 4a	819	Wooden frame, linen covering	4,077	1 (1)	Mainstay two-seat tractor type of the second half of WWI, equipping 19 Squadrons in France.
SE 5	1917-20	F	Hispano-Suiza or Wolseley Viper	630	Wooden frame, linen covering	5,205	3 (3)	Extremely successful late WWI single-seat fighter which entered front line service in April 1917.
Short Bomber	1915-17	B	RR Eagle or	2,272	Wooden frame, linen	83	0 (0)	Two-seat tractor type biplane. Development of Short 184 seaplane, delivered to 3 Wing RNAS spring 1916 and also to 7

			Sunbeam		covering			Sq RNAS late in the year. Took part in `strategic' operations as night bomber with 3 Wing from late 1916 but withdrawn from service April 1917.
Short 74	1914-15	MR	Gnome	954	Wooden frame, linen covering	18	0 (0)	Two-seat ship-borne float plane used by RNAS. Chiefly known for Cuxhaven raid.
Short 184 / 320	1915-21	TB, Recon , B	Sunbeam, Renault or RR Eagle	1,683	Wooden frame, linen covering	300	1 (1)	Highly successful RNAS two-seat biplane seaplane which became the first aircraft to sink a ship with a torpedo and was stationed at coastal bases around the UK. Later converted as a night bomber. Improved 320 variant (1918-19) used for anti-submarine and reconnaissance. Other sources suggest as many as 900 were built.
Short 827 / 830	1914-18	B, Recon	Sunbeam or Salmson	1,545	Wooden frame, linen covering	120	0 (0)	Two-seat reconnaissance/bomber seaplane, operated with RNAS from coastal air stations, seaplane carriers and armed merchantmen.
Sopwith Baby	1914-18	B and Recon	Gnome or Clerget	557	Wooden frame, linen covering	456	0 (0)	Single-seat twin-float seaplane development of the pre-war Schneider Trophy winning aircraft. Employed with little success by RNAS in anti-Zeppelin role over North Sea.
Sopwith Camel	1917-19	F	Clerget	422	Wooden frame, linen covering	5,490	2 (2)	Most successful British fighter of WWI in terms of combat kills, used by both RFC and RNAS. Also used in ground attack role. 2F1 variant developed for ship-board use.
Sopwith T1 Cuckoo	1918-23	TB	Wolseley Viper or Sunbeam Arab	999	Wooden frame, linen covering	150	0 (0)	Developed from 1916, RNAS land plane which could carry a single torpedo. Entered service too late to see action in WWI.
Sopwith Dolphin	1918-19	F	Hispano-Suiza	709	Wooden frame, linen covering	1,500	0 (0)	Fighter and ground attack aircraft that saw service from early 1918.
Sopwith Pup	1916-18	F	Le Rhone	357	Wooden frame, linen covering	1,770	2 (2)	Single-seat tractor, entered service with RFC in mid 1916. 290 served with RNAS and type carried out first deck landing on a moving ship. Also used in Home Defence role.
Sopwith Salamander	1918-19	FB	Bentley BR 2	1,139	Wooden frame, linen covering	882	0 (0)	Ground attack aircraft which entered service right at the end of WWI.
Sopwith Sneider	1915-18	F	Gnome	?	Wooden frame, linen covering	160	0 (0)	Seaplane version of the Tabloid which operated from RNAS coastal stations around the UK.
Sopwith Snipe	1918-26	F	Bentley BR 2	916	Wooden frame, linen covering	1,100	0 (0)	Development of the Camel, entered service right at the end of WWI and became the first mainstay fighter of the peacetime RAF.
Sopwith 1½ Strutter	1916-18	FB, Recon	Clerget	572	Wooden frame, linen covering	1,315	0 (0)	Used by both RFC and RNAS, a single or two-seat tractor type. Outclassed as a fighter by late 1916 and relegated to the bombing role. From early 1918 served as a trainer.

Sopwith Tabloid	1914-16	FB	Gnome	303	Wooden frame, linen covering	39	0 (0)	Single-seat Scout and light bomber, development of pre-war racer. Served with RFC and RNAS and carried out first raid on Germany
Sopwith Triplane	1917	F	Clerget	500	Wooden frame, linen covering	140	1 (1)	A single-seat triplane used exclusively by RNAS, highly manoeuvrable and with a good rate of climb but soon outclassed and replaced by the Camel.
Spad Scout (VII)	1916-18	F	Hispano Suiza	500	Wooden frame, linen covering	?	0 (0)	A highly successful French designed single-seat tractor biplane, built in limited numbers under licence in the UK for the RNAS and subsequently used on the Western Front by the RFC.
Vickers FB4 / FB 5 / FB 9 Gunbus	1914-16	F, Recon , T	Gnome	554	Wooden frame, linen covering	150?	0 (0)	Pusher type biplane scout (fighter), first 50 of which developed and built on Vickers' private initiative. Saw service with both the RFC and RNAS in France before reverting to Home Defence role. The last development, the FB 9 was used within the UK as a trainer.
Vickers FB 19	1916-17	F	Clerget or Le Rhone	407	Wooden frame, linen covering	36	0 (0)	Used primarily in UK in the Home Defence and training role.
White and Thompson No.3	1915-16	MR	Beardmore	c.1,000	Wooden hull and frame.	8	0 (0)	Two-seat anti-submarine biplane flying boat used in extremely limited fashion by the RNAS.
White and Thompson `Bognor Bloater'	1915-16	MR	Renault	?	Wooden monocoque fuselage.	10	0 (0)	Two-seat coastal patrol biplane used in extremely limited fashion by the RNAS, operating from the coastal air stations at Eastbourne, Great Yarmouth and Killingholme.
Wight 840	1915-17	TB	Sunbeam	c.2,000	Wooden frame, linen covering	70	0 (0)	Two-seat torpedo seaplane used by the RNAS. Operated from Felixstowe in the anti-submarine role.
Wight Pusher	1914-16	Recon	Salmson	c.1,500	Wooden frame, linen covering	11	0 (0)	Two/three-seat reconnaissance seaplane with folding five-bay wings. Two on board Ark Royal in the Dardanelles, remainder at coastal stations.
Wight `converted' Seaplane	1917-?	MR	RR Eagle or Sunbeam Maori	1,708	Wooden frame, linen covering	37	0 (0)	Two-seat biplane used by the RNAS in the anti-submarine role from early 1917, flying from Calshot, Dover and Portland.

Appendix 1.2: Aircraft utilised by the Imperial German Military Air Service and the Imperial Navy Service within the UK 1914-1918

Manufacturer / Type	Period of Service	Role	Power Plant	Weight (Kg)	Airframe Construction	Total Produced	Survivors: Global (UK)	Notes
Friedrichshafen FF 29	1914-15	B	Mercedes D II	?	?	?	0 (0)	Single engine biplane Float-plane with a crew of two which was utilised by the German navy in small-scale nuisance raids against UK shipping and coastal targets.
Gotha G.IV and V	1916-18	B	2 x Mercedes D IVa	2,391	Plywood frame with canvas covering	232	0 (0)	Long range bomber with crew of three. By late 1916 the effectiveness of Zeppelins had been neutralised by incendiary bullets and improved defences, so a special unit (Kampgeschwader 3) equipped with GIVs was established in order to bomb London, which it did from 1917 onwards.
Zeppelin (Staaken) R. VI	1917-18	B	4 x Maybach or Mercedes D IVa	11,462	?	18	0 (0)	Heavy bomber with crew of seven and endurance of between seven and eight hours. Known as the `Giant', it took part in raids on France and the UK from 1917 onwards.

Appendix 1.3: Aircraft utilised by the RAF and Fleet Air Arm within the UK 1919-1936

Manufacturer/Type	Period of Service	Role	Power Plant	Weight (Kg)	Airframe construction	Total Produced	Survivors: Global (UK)	Notes
Armstrong Whitworth Atlas	1927-35	AC, Coms, T	AS Jaguar IVc	1,159	Tubular metal frame, linen covering	446	0 (0)	Two-seat general purpose biplane, the first to be specifically designed for Army co operation work, it became operational in late 1927, remaining in service for six years, finally as a communications aircraft and advanced trainer.
Armstrong Whitworth Siskin	1924-32	F	AS Jaguar	828	Tubular metal frame, linen covering	534	0 (0)	Important early inter-war period RAF single-seat day fighter which was highly successful and exported.
Avro Aldershot	1924-25	B	RR Condor III	?	Wooden frame, linen covering	15	0 (0)	A heavy, day, long range bomber with crew of 5. Equipped only 99 Sq RAF.
Avro Anson	1936-68	MR,T	2x AS Cheetah	2,440	Tubular steel with spruce and plywood covering and Bakelite plywood wings	11,000	30 (16)	Introduced as GR aircraft, later adopted as principal trainer. Only one wartime military version (Mk I) survives. First RAF aircraft with retractable undercarriage.
Avro Bison	1922-29	Recon, MR	Napier Lion	1,892	Wooden frame, linen covering	63	0 (0)	A biplane reconnaissance aircraft with a crew of 3 to 4 which equipped 3 and 22 Sq RAF before passing to FAA, who operated it with 4 UK based flights. Produced in two main variants and superseded by the Fairey IIIF in 1929.
Avro Tutor/Prefect	1935-39	T	AS Lynx	?	Tubular metal frame, linen covering	795	3 (1)	Two-seat trainer chosen to replace the Avro 504, 380 of which were in RAF service, many coming on to the civilian market at the end of their careers. Also used extensively abroad.
Blackburn Baffin	1934-36	TB	Bristol Pegasus	1,900	Composite wood and metal frame, linen covering	77	0 (0)	Two-seat carrier borne torpedo bomber. Succeeded the Ripon as the FAA's principal strike aircraft. Served with three FAA squadrons. 62 of the production run were actually converted Ripons.
Blackburn Blackburn	1923-33	MR	2 x Napier Lion IIB or V	1,833	Composite wood and metal frame, linen covering	50-70	0 (0)	Single engine biplane reconnaissance aircraft used by the FAA, either from carriers or from land bases. Replaced by the Fairey IIIF. Equipped two UK based flights.
Blackburn Dart	1922-33	TB	Napier Lion	1,746	Composite wood and metal frame, linen covering	70	0 (0)	Single-seat carrier torpedo bomber which equipped three UK based flights of the FAA. Made the first night landing upon a carrier and a twin float seaplane version also equipped four RAF Reserve Training Schools.
Blackburn 14/24 Iris	1930-32	MR	3 x RR Condor	?	Wooden hull and frame and linen covering.	8	0 (0)	Large reconnaissance seaplane, five versions of which were built and which carried out many long distance flights.
Blackburn 20/32 Perth	1934	MR	3 x RR Buzzard	?	Metal hull and frame, linen airframe covering	4	0 (0)	Triple engine flying boat which saw limited service.
					Composite wood and			

Blackburn Ripon	1929-34	TB, MR	Napier Lion XIA	1,934	metal frame, linen covering or all metal	92	0 (0)	Two-seat carrier-borne torpedo bomber biplane which superseded the Dart in FAA service. Could also be converted for use in the long range reconnaissance role.
Blackburn Shark	1935-38	TB	AS Tiger VI	1,969	Metal structure, with Alclad monocoque fuselage and fabric covered wings	200	0 (0)	Two or three-seat biplane torpedo bomber which served with three FAA squadrons before being relegated to the training role from Lee on Solent.
Boulton Paul Overstrand	1935-38	B	2 x Bristol Pegasus	3,607	Tubular metal frame, linen covering	24	0 (0)	Uprated version of the Sidestrand, became the first RAF aircraft to mount a power operated turret, entering service with 101 Sq in early 1935.
Boulton Paul Sidestrand	1929	B	2 x Bristol Jupiter VIII	2,731	Tubular metal frame, linen covering	18	0 (0)	Large twin engine high performance biplane replacement for the DH 10 daylight medium bomber. Carried crew of 3-5 and equipped 101 Sq RAF at Bircham Newton.
Bristol Bulldog	1929-37	F	Bristol Jupiter	951	Tubular metal frame, linen covering	500	1 (1)	Single-seat biplane fighter, one of the last open cockpit types to see widespread service with the RAF, equipping 10 Squadrons and at one point equipping 70% of the home defence fighter force.
De Havilland Tiger Moth	1931-47	T	De Haviland Gypsy	525	Tubular steel and Spruce with Plywood and fabric covering	8,565	400+ (42)	Principal biplane elementary flying trainer in UK and Commonwealth training schools. Adaptation of a civilian design. Many survive.
Fairey Fawn	1924-29	B, AC	Lion II	?	Wooden frame, linen covering	48	0 (0)	Two-seat biplane designed to replace the DH 9 in the day bomber, reconnaissance and Army co operation role.
Fairey Flycatcher	1923-34	F	AS Jaguar III or IV or Bristol Mercury II	923	Wooden wings with linen covering, composite wood and metal fuselage, metal and fabric covered	195	0 (0)	The only British fighter in FAA service between 1924 and 1932 and both highly successful and highly significant. Land based and carrier borne variants.
Fairey Fox	1926-31	B	Curtis D12	?	Wooden frame, linen covering	35	0 (0)	Technically innovative replacement for the Fawn day bomber which included water cooled engine, metal propellor, retractable radiator and high efficiency wing aerofoils. Later models (the Mk II) was all metal in construction.
Fairey Gordon / Seal	1931-34	B, Recon	AS Panther IIA	1,590	Tubular metal frame, linen covering	270	0 (0)	A two-seat daylight bomber and reconnaissance aircraft designed to replace the Fairey III, with which it shared many design similarities. Used predominantly by the RAF but also by the FAA who renamed their variant the Seal.
Fairey Hendon	1936-39	B	2 x RR Kestrel	5,805	Tubular steel and light alloy frame, linen covering	14	0 (0)	Highly innovative in design: first RAF cantilever monoplane heavy bomber. Carried crew of 5 and equipped 38 Sq RAF. Plans to produce a further 60 aircraft were dropped in favour of other newer designs.
Fairey Seafox	1937-40	MR	Napier Rapier	1,729	All metal with monocoque fuselage and fabric covered wings	64	0 (0)	Two-seat reconnaissance biplane and spotter seaplane used by the FAA. Equipped a number of cruisers and catapult flights on the outbreak of WWII, and took part in the successful action against the Graf Spee.

Gloster Gamecock	1926-31	F	Bristol Jupiter VI	874	Wooden frame, linen covering	90	0 (0)	Single-seat day fighter which entered service with five RAF squadrons in 1926. The last all wooden RAF fighter to enter service.
Gloster Gauntlet	1934-40	F	Bristol Mercury	1,257	Tubular metal frame, linen covering	228	0 (0)	Single-seat biplane fighter, already largely obsolete by its introduction to service. Last open cockpit fighter in RAF service, which equipped 15 squadrons.
Gloster Grebe	1923-29	F	Bristol Jupiter IV	779	Wooden frame, linen covering	129	0 (0)	Successful single-seat day fighter which served with 6 RAF squadrons before being replaced by the Siskin.
Handley Page Heyford	1930-39	B	2 x RR Kestrel or Tiger	4,181	Tubular metal frame, linen covering	254	0 (0)	Four seat biplane heavy night bomber, the last biplane heavy bomber to enter RAF service, equipping 99 Sq from July 1933.
Handley Page Hinaidi	1929-35	B	Jupiter, AS Jaguar, RR Buzzard or RR Kestrel	1,386	Wooden frame, linen covering	52	0 (0)	Four seat biplane heavy night bomber. Developed version of the Hyderabad which could carry an extra 350 Ib in bombs, equipping 99 Sq RAF from late 1929.
Handley Page Hyderabad	1925-34	B	2 x Lion	4,050	Wooden frame, linen covering	45	0 (0)	Twin engine heavy night bomber which saw service with 4 UK based squadrons, starting with 99 Sq at Bircham Newton. The RAF's last all wooden bomber.
Hawker Audax	1932-41	AC, T	RR Kestrel	?	Tubular metal frame, canvas and metal covering.	650	1 (1)	Two-seat biplane close support and reconnaissance aircraft for Army co operation work. Replaced the AW Atlas and eventually became a trainer, in which role it served until 1941.
Hawker Demon	1931-39	F	RR Kestrel	?	Tubular metal frame, canvas and metal covering.	234	1 (1)	Two-seat biplane fighter, adaptation of the Hart bomber with uprated performance and armament. A later variant had a hydraulically operated turret installed in the rear cockpit.
Hawker Fury / Nimrod	1931-39	F	RR Kestrel	1,188	Tubular and high tensile rolled steel frame, canvas and metal covering.	230	3 (3)	Single-seat biplane selected as the standard fighter for the RAF, entering service with 43 Sq in 1931. Converted by the FAA for use on aircraft carriers as the Nimrod. Incorporated hydraulically operated brakes.
Hawker Hardy	1935-43	B, GR, Tug	RR Kestrel	1,452	Tubular metal frame, canvas and metal covering.	47	0 (0)	Two-seat biplane light bomber which competed in terms of performance with contemporary fighters. It entered service with 3 overseas squadrons in 1935 but was quickly relegated to home service with the Auxiliary Air Force and then became a tug.
Hawker Hart / Osprey	1930-43	B, MR, Tug	RR Kestrel	1,150	Tubular steel frame, canvas and metal covering.	969	2 (2)	Two-seat biplane light bomber which entered RAF service in 1930 and eventually equipped seven UK-based squadrons as the Hart. Fitted with folding wings and flotation gear and renamed the Osprey, it also equipped FAA from 1932 onwards.
Hawker Hind	1935-40	B	RR Kestrel	1,477	Tubular metal frame, canvas and metal covering.	692	2 (2)	Two-seat biplane day bomber replacement for the Hawker Hart, with which it shared many design characteristics.
Hawker Horsley	1926-35	B, TB	RR Condor or AS Leopard	2,163	Mk I all wooden, Mk II composites, Mk III all metal.	38	0 (0)	Single engine biplane day bomber with crew of 2, later developed as a land plane torpedo bomber (Mk III). The Mk I was the last all wooden aircraft to be constructed by Hawkers.
Hawker Woodcock	1925-28	F	AS Jaguar II	638 (Mk	Wooden frame, linen	63	0 (0)	The first fighter aircraft built in Britain following the end of WWI.

			or Bristol Jupiter IV	I) 943 (Mk II)	covering			Single-seat which followed conventional lines and was superseded by the Gamecock.
Miles Nighthawk	1937-38	T	DH Gipsy Six	?	?	?	0 (0)	Trainer.
Nieuport Nighthawk	1919-23	F	AS Jaguar or Bristol Jupiter	?	Wooden frame, linen covering	70	0 (0)	French designed fighter manufactured under licence in the UK for use as RAF fighter in the immediate inter-war period.
Nieuport Nightjar	1922-23	F	Bentley BR 2	984	Wooden frame, linen covering	18	0 (0)	Single-seat carrier-borne fighter, a conversion of surplus Night Hawks, which saw use with the FAA.
Parnall Panther	1920-23	F, Recon	Bentley BR 2	603	Wooden frame, linen covering	150	0 (0)	Two-seat day fighter and reconnaissance aircraft, one of the first to be designed specifically to operate from a carrier, which saw use with the FAA in the early inter-war period.
Saro Cloud	1933-36	T	2 x AS Serval	?	All metal	17	0 (0)	Amphibious flying boat trainer which saw limited service with 48 Sq RAF at Manston and the Seaplane Training Squadron at Calshot.
Saro London	1934-44	MR	2 x Bristol Pegasus	?	All metal	33	0 (0)	Flying boat.
Short Rangoon	1931-36	MR	3 x Bristol Jupiter	?	Alloy hull and frame, linen covering	6	0 (0)	Triple engine biplane amphibious flying boat used in limited fashion in UK by 210 Sq at Pembroke Dock before being sold to Imperial Airways.
Supermarine Southampton	1925-36	MR	2 x Napier Lion V	?	Alloy hull , wooden frame, linen covering	66	1 (1)	Twin engine biplane flying boat which served both in the UK and Far East, achieving fame for long distance flight.
Vickers Vildebeest	1933-40	TB	Bristol Perseus or Pegasus	2,147	Tubular steel frame with fabric covering and metal panels.	152	0 (0)	Two (later three) seater biplane torpedo bomber, one of the most prominent utilised by the RAF between the wars but which was eventually replaced in UK service by the Beaufort..
Vickers Vimy	1919-28	B	2 x RR Eagle or Hispano Suiza	2,463	Wooden frame, linen covering	221	1 (1)	Twin engine, biplane heavy bomber with crew of three. Entered service immediately after WWI. Converted civilian example was the first aircraft to fly the Atlantic non-stop.
Vickers Virginia	1924-38	B	2 x Napier Lion V	4,386	Wooden frame, linen covering	260	0 (0)	Twin engine biplane bomber with crew of four which equipped several RAF Squadrons.
Westland Wallace	1933-36	B	Bristol Pegasus	1,490	Tubular steel frame with fabric covering and metal panels	174	1 (1)	Development of the Wapiti. Two-seat biplane, the Mk II models had canopies covering both cockpits. Three UK based squadrons operated the aircraft.
Wetsland Walrus	1921-25	MR	Napier Lion III	2,270	Wooden frame, linen covering	36	0 (0)	Three-seat biplane spotter, first equipped 3 Squadron RAF at Leuchars before joining FAA Fleet Spotter Flights at Gosport.
Westland Wapiti	1927-39	B, AC, T	Bristol Jupiter VI	1,490	Wooden wings and rear fuselage. Duralumin front fuselage frame. Canvas and metal	516	0 (0)	General purpose two-seat biplane employing first of new construction techniques and materials. Extremely reliable, it served in the UK and abroad until 1939.

				panel covering.			

Appendix 1.4: British Manufactured Aircraft utilised by the RAF and Fleet Air Arm within the UK 1937-45

Manufacturer/Type	Period of Service	Role	Power Plant	Weight (Kg)	Airframe construction	Total Produced	Survivors: Global (UK)	Notes
Airspeed Horsa	1942-45	Trans, TC	-	3,800	Spruce, plywood covered.	3,655	0 (0)	Principal British assault glider of WW2. Used in Sicily, D-Day, Arnhem and the Rhine Crossing. No complete survivors but several smaller sections.
Airspeed Oxford	1937-54	T	2x AS Cheetah	2,085	Semi-monocoque fuselage, spruce and birch wings, plywood covering.	4,411	6 (2)	Advanced pilot trainer; also utilised on a smaller scale for bombing and gunnery training.
Armstrong Whitworth Albemarle	1941-44	Trans, Tug	2x Bristol Hercules	10,260	Tubular steel frame with spruce and plywood covering	602	0 (0)	First British military aircraft with tricycle undercarriage. Constructed in wood and steel to save on alloys. Used in Sicilian and D-Day airborne campaigns.
Armstrong Whitworth Whitley	1937-44	B, MR, Trans	2x AS Tiger or RR Merlin	8,800	Metal monocoque fuselage, fabric covered wings	1,466	0 (0)	First full production RAF heavy bomber, equipped 4 Group RAF Bomber Command until replaced by Halifax from 1941. Impressed into MR role for the Battle of the Atlantic and later as a glider tug and paratrooper transport.
Avro Manchester	1940-42	B,T	2x RR Vulture	14,150	Metal monocoque fuselage. All metal.	209	0 (0)	First of new generation of RAF heavy bombers to enter service. Revolutionary engines and extensive use of hydraulics caused constant problems. Important precursor to the Lancaster. Relegated to training June 1942.
Avro Lancaster	1942-58	B,MR, ASR	4x RR Merlin or 4x Bristol Hercules (Mk II)	16,750	Metal monocoque fuselage. All metal.	7,377	18 (4)	Principal RAF Heavy Bomber 1942-45. Took part in 1,000 bomber raids, Battles of the Ruhr, Hamburg, Berlin and the raids on Augsburg, the Dams, Peenemunde and Dresden. Relegated to MR and ASR duties postwar. No Mk IIs survive.
Avro York	1943-51	Trans	4x RR Merlin	?	All metal	208	2 (2)	Transport version of the Lancaster. Used extensively post war in the Berlin airlift.
Blackburn Botha	1940-42	TB, GR, T	2x Bristol Perseus	?	All metal	580	0 (0)	Chosen as main torpedo bomber for RAF Coastal Command in 1939. Numerous problems with suitability and handling. Rapidly relegated to training duties.
Blackburn Firebrand	1945-53	F,TB	Bristol Centaurus	5,379	All metal stressed skin	300	0 (0)	FAA carrier based fighter and torpedo attack aircraft. Superseded by the Westland Wyvern in 1953.
Blackburn Skua/Roc	1938-42	F, FB, Tug	Bristol Perseus	2,490	All metal stressed skin	326	1 (1)	First FAA monoplane to enter service. A two-seat dive bomber (Skua) of which 190 were built shot down the first German aircraft in WWII. The two-seat fighter version (Roc) of which 136 produced was the first FAA aircraft to be equipped with a power operated turret. Both relegated to target tug and training duties by 1941.

Boulton Paul Defiant	1939-45	F,NF, Tug, ASR	RR Merlin	2,722	All metal	267	1 (1)	Battle of France/Battle of Britain fighter with hydraulic gun turret became most significant night fighter in the Blitz, prior to development of AI and GCI. Later became target tug and undertook ASR.
Bristol Beaufort	1938-46	B	2x Bristol Taurus or 2x PW Twin Wasp	5,957	Duralumin, hiduminium and Alclad monocoque fuselage and wings.	2,129	4 (1)	RAF Coastal Command bomber used on shipping strikes 1939-43. Relegated to the Mediterranean 1944 and then the Pacific theatre in 1945.
Bristol Beaufighter	1940-60	F,NF	2x Bristol Hercules or 2x RR Merlins	7,100	All metal monocoque fuselage and wings.	5,928	6 (4)	First purpose-built night fighter; mainstay of night defence 1941-42 and for anti-shipping operations 1942-45. Merlin powered variant very rare.
Bristol Blenheim	1937-44	B,F	2x Bristol Mercury	4,450	All metal	6,260	20 (3)	Night fighter and bomber version used from UK early in war. Suffered heavy losses in France and in the use of 2 Group RAF 1941-42. No fighter versions extant.
De Havilland Don	1937-40	T, Comms	Gipsy King	?	Tubular metal frame, linen covering	50	0 (0)	Single engine monoplane trainer and communications aircraft used in small numbers up to the outbreak of WWII.
De Havilland Mosquito	1941-50	F,B, NF	2x RR Merlin	6,394	Spruce with Plywood and fabric covering	7,781	20 (6)	Significant bomber and multi-role aircraft from 1942. Took part in many famous raids such as attacks on Amiens prison, Gestapo headquarters in Bergen.
Fairey Albacore	1940-45	B	Bristol Taurus II or XII	3,272	Metal monocoque fuselage, fabric covered metal wings.	803	1 (1)	FAA biplane torpedo bomber, operating from aircraft carriers. Intended to replace the Swordfish but superseded by the Barracuda.
Fairey Barracuda	1944-53	B	RR Merlin	3,954	All metal. Steel cockpit frame and engine mounts, remainder alloy monocoque.	2,541	1 (1)	First FAA monoplane torpedo bomber. Replaced Swordfish. Took part in Tirpitz strike.
Fairey Battle	1937-45	B	RR Merlin	3,015	All metal.	2,419	3 (1)	RAF light bomber. Suffered heavy losses in Battle of France. Relegated to training 1940.
Fairey Firefly	1943-55	B, MR	RR Griffon	4,422	Alclad monocoque fuselage, stressed skin light alloy wings	1,638	10+ (4)	FAA (mostly carrier borne) two-seat reconnaissance/bomber. Took part in attacks on Tirpitz and Norwegian coast 1944 and in 1945 moved to Pacific theatre.
Fairey Fulmar	1940-44	F	RR Merlin	3,182	All metal stressed skin	600	1 (1)	FAA two-seat carrier borne fighter, first to have eight machine guns. Rapidly outclassed due to lack of speed.
Fairey Swordfish	1936-45	B	Bristol Pegasus	2,406	Tubular steel with canvas an aluminium covering.	2,391	7 (3)	FAA carrier based biplane torpedo bomber. Took part in the attack on Taranto, the sinking of the Bismarck and the Channel Dash.
General Aircraft Ltd Hamilcar	1942-45	Trans	2x Bristol Mercury	8,350 11,580	Spruce with plywood and fabric covering.	432	1 (1)	Principal heavy lift transport glider (only 20 produced with engines) used in the D-Day and Arnhem campaigns.
General Aircraft Ltd Hotspur	1941-45	T	-	1,375	Spruce with plywood covering.	1,061	0 (0)	Principal glider pilot trainer, tandem seats with room in fuselage for troops. Used purely in training by the Army air Corps.

Gloster Gladiator	1937-41	F	Bristol Mercury	1,565	Tubular steel with canvas and aluminium covering.	767	5 (3)	Last RAF biplane fighter. Single-seat with enclosed cockpit. Took part in Norwegian campaign, saw limited use in the BoB. Relegated to service in North Africa and the Mediterranean 1941.
Gloster Meteor	1944-61	F	2x RR Welland or 2x RR Derwent	3,995	All metal stressed skin.	3,875	47+ (42)	First RAF jet fighter to enter service (July 1944) to counter the V-1 flying bomb. Used extensively post war. Wartime versions are rare.
Handley Page Halifax	1940-47	B, Trans	4x RR Merlin or 4x Bristol Hercules	15,340	Light alloy monocoque fuselage.	6,176	2 (1)	Significant heavy bomber from 1941-45. Equipped 4 and 6 Groups RAF Bomber Command in Yorkshire. Successive improvements. Earlier variants relegated to Coastal Command and transport. Took part in all major Bomber Command raids.
Handley Page Hampden / Hereford	1938-44	B, TB	2x Bristol Pegasus or 2x Napier Dagger	5,340	All metal.	1,680	1 (1)	The Hampden and the few Dagger powered Herefords (100) to reach service saw significant use with 5 and 6 Groups Bomber Command in the early war period. Relegated to Coastal Command from 1942-44 as a torpedo bomber.
Handley Page Harrow	1937-45	Trans	2x Bristol Pegasus	?	?	100	0 (0)	Transport aircraft, which whilst hurriedly impressed in the Middle East as a bomber, saw limited use in the UK as a transport and communications aircraft.
Hawker Hector	1937-42	AC, Tug	Napier Dagger	1,694	Tubular steel frame,plywood and canvas covering.	178	0 (0)	Interim two-seat biplane replacement for the Audax, last biplane to enter RAF service (with 4 Sq RAF in early 1937). Remained with Auxiliary squadrons until 1940 with a handful of aircraft carrying out dive bomber attacks against Germans in that year. Relegated for use as glider tug within the UK.
Hawker Henley	1938-	Tug	RR Merlin	?	Tubular steel frame, plywood and canvas covering.	200	0 (0)	Initially conceived as a light bomber but on delivery was immediately relegated as a target tug working with Air Firing and Anti-Aircraft Co-operation units.
Hawker Hurricane	1937-45	F,FB	RR Merlin	2,118	Tubular steel and aluminium alloy fuselage frame with light wooden formers and canvas covering. Steel and stressed aluminium alloy wings.	14,533	45+ (29)	Most numerous RAF fighter in Battle of Britain, from 1941 relegated to Mediterranean and Far East in fighter bomber and anti-shipping roles. Also adapted as a convoy protection fighter on Russian and Atlantic routes, launched from Merchantmen. Served on 17 battlefronts including Battle of France, Norway, Battle of Britain, Malta, North Africa, Sicily, Adriatic and Burma campaigns.
Hawker Tempest	1944-48	F,FB	Napier Sabre	4,128	All metal.	1,401	20+ (5)	Late war RAF fighter, one of the last with a piston engine. Took part in the V1 campaign and saw combat against German jets.
Hawker Typhoon	1941-45	F,FB	Napier Sabre	3,992	All metal.	3,330	1 (1)	Principal RAF fighter-bomber from 1943-45. Played major tactical role in the NW Europe ground campaign from the invasion of Normandy until the end of the war.
Miles Magister	1937-45	T	DH Gypsy	?	Spruce and plywood.	1,227	14 (8)	Training and communications aircraft.
Miles Master / Martinet	1939-50	T	Bristol Mercury or PW 1535	1,950	Spruce and Plywood covering.	4,835	1 (1)	Advanced pilot trainer which equipped secondary flying training schools and also saw limited use as a target tug for gunnery practice.
Percival Petrel	1939	Comm	2 x DH	?	Tubular metal frame,	8	0 (0)	Twin engine communications aircraft which saw limited use with

		s	Gipsy Six		canvas and metal covering			24 Sq RAF.
Percival Proctor	1939-50	T, Comm s	DH Gipsy Queen	1,076	Spruce and plywood, fabric covered.	912	13 (6)	Communications aircraft.
Saunders Roe Lerwick	1939-42	MR	2x Bristol Hercules	?	All metal.	21	0 (0)	Flying boat used in limited fashion by Coastal Command.
Short Stirling	1941-46	B, Trans RCM	4x Bristol Hercules	17,659	All metal.	2,374	0 (0)	The first of the RAF's four engine heavy bombers to enter service. By mid 1943 it had been relegated from the primary bombing role due to its limited service ceiling and heavy losses. Reused as a transport, glider tug and by 100 Group RAF in the Radio Counter Measures or electronic warfare role.
Short Stranraer	1935-41	MR	2x Bristol Pegasus	?	Metal and fabric covering.	17	1 (1)	Pre-war flying boat. Some use by Coastal Command at outbreak of war.
Short Sunderland	1938-56	MR	4x Bristol Pegasus or 4x PW R 1830	15,663	All metal.	739	8 (4)	Flying boat. Principal maritime reconnaissance and anti-submarine aircraft in use with RAF Coastal Command. Operated in all theatres but particularly successful in the battle of the Atlantic due to its heavy armament and long endurance.
Supermarine Spitfire/Seafire	1938-50	F	RR Merlin or RR Griffon	2,545	All aluminium monocoque fuselage and wings.	22,928	300+ (59)	Principal RAF day fighter from early 1941 until the end of the war. Operated in all theatres and in all major campaigns and also adapted for use on aircraft carriers as the Seafire.
Supermarine Walrus/Sea Otter	1939-45	ASR	Bristol Pegasus	2,220	Spruce and plywood covering.	740	3 (3)	Flying boat. Principal air sea rescue aircraft. Saved at least 6,000 aircrew.
Vickers Warwick	1943-46	MR, ASR Trans	2x Bristol Centaurus	12,700	Aluminium and steel geodetic structure with fabric covering.	700	0 (0)	Intended replacement for the Wellington. Used mainly by RAF Coastal Command for ASR and MR duties, also subsequently as a transport.
Vickers Wellington	1937-53	B,T, MR	2x Bristol Hercules	8,400 - 12,000	Aluminium and steel geodetic structure with fabric covering.	11,461	2 (2)	Principal RAF heavy bomber 1939-42, prior to advent of the four-engine heavies. Relegated to Mediterranean and Operational Training Units 1941-44. Limited use by Coastal Command. Took part in the first bombing raid of the war.
Westland Lysander	1938-47	AC	Bristol Perseus	1,840	Metal and fabric covering.	1,898	9 (4)	Used in the Army co-operation role and subsequently for operations with the Resistance and SOE in France.
Westland Whirlwind	1940-43	FB	2x RR Peregrine	3,699	All metal.	112	0 (0)	Innovative fighter-bomber. Suffered engine problems and only ever equipped two squadrons, used in support of bombing operations and for attacks on France.

Appendix 1.5: US Manufactured Aircraft utilised by the RAF and FAA within the UK 1939-45

Manufacturer/Type	Period of Service	Role	Power Plant	Weight (Kg)	Airframe construction	Total Produced	Survivors: Global (UK)	Notes
Bell Aircobra	1941-42	F	Allison V12	2,540	Stressed aluminium	9,588	10 (0)	Innovative mid-engine fighter aircraft with tricycle undercarriage, approximately 50 of which entered RAF service with 601 Sq.
Boeing Fortress	1941-46	B, MR, RCM	4x Wright R-1820	14,855	All metal semi-monococque fuselage	12,731	23 (3)	220 of various versions delivered for RAF use. Initially operated 1940-41 in daylight bombing tests, subsequently used by Coastal Command and 100 Group Bomber Command in early RCM role.
Brewster Bermuda	1943-45	Tug	Wright Cyclone	4,440	All metal.	1,000+	0 (0)	Ordered as a land-based dive-bomber, 950 were delivered for RAF service, most of which are believed to have served in the UK as target tugs and none are known to have flown operationally.
Brewster Buffalo	1941-42	F	Wright Cyclone	2,100	All metal.	447	5 (0)	Pre-war USAAC fighter. 209 delivered to RAF/FAA, of which only 28 are believed to have operated in UK, the remainder going to the Far East.
Chance Vought Corsair	1943-45	F	Pratt and Whitney Double Wasp	4,025	All metal.	12,571	60 (4)	Carrier-based fighter, 2,012 of which were supplied for FAA use. Mostly saw action in the Pacific and Far East, but a few operated within the UK.
Consolidated Catalina	1941-45	MR,ASR	2x PW R1830	9,938	All metal.	4,000+	69 (3)	Long-range flying boat, 771 of which were delivered to the RAF/RCAF/RAAF/RNZAF. Equipped 9 UK-based Squadrons of RAF Coastal Command in the anti-U Boat and reconnaissance role.
Consolidated Liberator	1941-47	B, MR	4x PW R1830	16,556	All metal except fabric covered control surfaces.	19,203	15 (2)	1,865 delivered for RAF use (mostly in Far East). Used in the UK by RAF Coastal Command in the maritime reconnaissance/anti-submarine role.
Curtiss Kittyhawk	1941-42	F, AC	RR Merlin or Allison V1710	3,039	All metal.	13,738	20 (2)	Approximately 902 were used by the RAF in the European Theatre, mostly for Army co-operation work as fighter-bombers.
Curtiss Seamew	1941-44	T	Ranger SGV	1,869	All metal stressed skin.	800	0 (0)	Two-seat single engine reconnaissance aircraft. Approximately 250 scheduled for delivery to the FAA on lend lease, but only approximately 100 actually received. Saw no operational service and from 1943 operated in the training role, some serving with training squadrons at Worthy Down, Hants.
Curtiss Tomahawk	1941-43	T, AC	Allison V1710	2,636	All metal.	1,400	10 (0)	Approximately 1,180 taken on strength by RAF, RAAF and SAAF for use in North Africa and Far East. Used in limited capacity in UK.

Douglas Boston/Havoc	1940-46	B, NF	2x Pratt and Whitney Twin Wasps or 2x Wright R2600	5,172	All metal.	7,385	14 (1)	A total of 1,250 Boston light bombers were delivered to the RAF (used in UK with 2 Group and later 2 Tactical Air Force). Also 100 night fighter versions (Havoc) used by RAF.
Douglas Dakota	1942-50	Tug, Trans, TC	2x PW R1830	7,657	All metal.	10,691	550 (16)	Conversion of pre-war civilian airliner type. A total of 1,920 delivered for RAF use and became the principal transport aircraft. Took part in the D-Day and Arnhem campaigns and saw action in all theatres.
Grumman Avenger	1943-46	TB	Wright R2600	?	All metal. Semi monocoque fuselage.	9,836	60 (3)	Three seat carrier based torpedo bomber. From 1943 onwards 957 delivered to FAA (initially known as Tarpon), of which it equipped 9 squadrons. Use in all theatres.
Grumman Hellcat		F	Pratt and Whitney Double Wasp	4,101	All metal.	12,275	22 (3)	1,262 supplied to FAA as replacement carrier borne fighter under lend-lease. Initially called the Gannet. Served 1943-45. Served in all theatres.
Grumman Martlet/Wildcat	1940-45	F	Wright Cyclone	2,011	All metal.	7,316	35 (4)	531 supplied to FAA as carrier borne fighter, (known initially as Martlet). Served 1940-44. Took part in Norwegian campaign with great success.
Lockheed Hudson	1939-46	MR, ASR	2x Wright Cylcone or 2x PW Twin Wasp	5,262	All metal.	2,500+	16 (1)	2,695 delivered for RAF service, operating within the UK with Coastal Command in the anti submarine and maritime reconnaissance role. Also used in the Mediterranean and Far East.
Lockheed Ventura	1942-44	B, MR	2x PW Double Wasp	7,836	All metal.	2,070+	15 (1)	781 delivered for RAF service, initially with Bomber Command as daylight medium bombers. After heavy losses relegated to Coastal Command.
North American Harvard	1942-56	T	PW Wasp or A1340	2,549	Steel frame fuselage, fabric and ply, later alloy covered.	9,577+	400 (23)	5,125 delivered for RAF and commonwealth usage as trainers. Equipped many Flying Training Schools in the UK and abroad.
North American Mitchell	1942-45	B	2x wright Cyclone	9,208	All metal.	9,816	45 (5)	Total of 837 delivered to RAF. Used in the UK by 4 Squadrons of 2 Group RAF as medium tactical bomber and later by the 2 TAF.
North American Mustang	1942-47	FB, AC	Allison 1710 or RR Merlin	2,858	All metal.	15,586	257 (8)	2,517 delivered for RAF use. Initially ordered as a fighter, mostly used by 2 TAF in the fighter bomber/Army Co-operation role.
Stinson Reliant	1944-45	T	Lycoming R680	1,276	Tubular steel and duralumin frame, duralumin and canvas covering.	?	10 (0)	High-wing monoplane which first appeared in 1933, with 500 delivered to FAA for use as navigation trainers and communications aircraft under the lend-lease arrangement.
Vought Sikorsky Chesapeake	1941-44	T	PW R1835 Twin Wasp Junior	2,256	Tubular metal fuselage with canvas covering, metal wings.	165	1 (0)	50 delivered for FAA use within the UK, flying from Lee-on-Solent and Arbroath. Tried operationally, quickly relegated to training with little significant use.
Vultee Vengeance	1941-47	Tug	Wright	4,672	All metal.	1,000	2 (0)	Intended as a dive-bomber 1,362 delivered to the RAF. Found

			Cyclone					inadequate for European theatre and the 500 within the UK subsequently used as target tugs.
Waco CG4A Hadrian	1942-45	Trans, TC	-	1,721	Tubular steel fuselage, wooden wings, fabric covering.	13,909	3 (1)	US designed assault glider, 1,095 of which were delivered for use by British Airborne forces.

Appendix 1.6: USAAF and USN Aircraft operating within the UK 1939-45

Manufacturer / Type	Period of Service	Role	Power Plant	Weight (Kg)	Airframe Construction	Total Produced	Survivors: Global (UK)	Notes
Bell P39 Aircobra	**1942-43**	**F**	**Allison V1710**	**2,545**	**All metal.**	**9,588**	**10 (0)**	**Unusual mid-engine fighter which saw extremely limited use with the VIII AAF. Used mostly in the Pacific.**
Boeing B17 Fortress	1942-45	B	4x Wright R1820	15,422	All metal semi-monococque fuselage	12,731	23 (3)	Mainstay daylight high-altitude heavy bomber used by 1st and 3rd Air Divisions of the VIII AAF 1942-45. Took part in all major raids.
Consolidated B24 Liberator	1941-45	B	4x PW R1830	16,556	All metal except fabric covered control surfaces.	19,203	15 (2)	Daylight high-altitude heavy bomber used by the 2nd Air Division, VIII AAF 1942-45. Also limited night use dropping agents, supplies etc and with the USN.
Douglas A20 Havoc	1942-45	B, Tug	2x Wright R2600	6,727	All metal.	7,385	14(1)	Light bomber used in extremely limited fashion by VIII AAF. Took part in the first US raids of the war from UK. Subsequently equipped three groups of IX AAF in UK.
Douglas A26 Invader	1944-45	B	2x PW R2800	10,365	All metal.	?	25 (0)	Medium bomber replacement for A20 and B26 from late 1944. Saw limited actual use in the UK, mostly equipping IX AAF units in mainland Europe.
Douglas C47 Skytrain	1942-45	Trans, Tug, TC	2x PW R1830	7,698	All metal.	10,691	550 (16)	Principal US transport and troop carrier. Operated by the IX AAF during the D-Day and Operation Market Garden campaigns.
Lockheed P38 Lightning	1942-44	F	2x Allison V1710	5,563	All metal.	8,300	18 (0)	Twin boom, twin-engine fighter aircraft, principal long-range escort July 1942 until the intro of the P47 (1942) and the P51 (1943). Withdrawn Sept 1944.
Martin B26 Marauder	1942-46	B	2x PW R2800	10,152	All metal.	4,500	5 (0)	Medium (and medium level) bomber operated successively by the US VIII and IX AAFs in the tactical role.
Noorduyn UC64 Norseman	1944-45	Comms	PW R1340	1,928	Metal frame with fabric covering.	?	25 (0)	Communications aircraft, converted from civilian model. Chiefly famous for being the type in which Glen Miller went missing late 1944.
North American P51 Mustang	1942-45	F	Allison 1710 or RR Merlin	2,858	All metal.	15,586	257 (8)	Principal USAAF fighter, equipping VIII and IX AAF from winter of 1943-44. VIII AAF operated as a long range escort, IX AAF in the tactical role.
Republic P47 Thunderbolt	1942-45	F, FB	PW Double Wasp	4,087	All metal	15,660	150 (2)	Important fighter with VIII and IX AAF from Dec 1942 until the end of the war. Initially used as an escort, increasingly fulfilled fighter-bomber role.
Waco CG4A	1942-45	Trans, TC	-	1,721	Tubular steel fuselage, wooden wings, fabric covering.	13,909	3 (1)	Principal US transport and troop-carrying glider, used in the Sicilian, D-Day and Market Garden airborne campaigns.

Appendix 1.7: Luftwaffe and Regia Aeronautica Aircraft operating over the UK 1939-45

Manufacturer / Type	Period of Service	Role	Power Plant	Weight (Kg)	Airframe Construction	Total Produced	Survivors: Global (UK)	Notes
Bf 109 (Messerschmitt)	**1937-45**	**F,FB**	**DB601 or 605**	**2,354**	**All metal.**	**35,000**	**45 (8)**	**Most significant fighter used over southern England during the Battle of Britain. From 1942-43 replaced by the FW190.**
BF 110 (Messerschmitt)	1938-45	F, NF	2x DB605	5,094	All metal.	6,050	6 (1)	Significant twin-engine heavy fighter aircraft in the Battle of Britain. Operated over the West Country, southern England and east coast as far north as the Shetlands.
Dornier 17/215	1937-42	B	2x BF	5,210	All metal.	1,700	0 (0)	Significant medium bomber in the Battle of Britain and early Blitz period.
Dornier 18	1935-41	MR	2x JJ 205	5,850	All metal.	100	0 (0)	Operated in UK coastal waters, some lost on operations.
Dornier 217	1941-44	B	2x DB 603	9,065	All metal.	1,905	0 (0)	Significant later war bomber operating over UK.
Focke Wulf 190	1941-45	F, FB	BMW 801	3,470	All metal.	20,051	7 (2)	Used as a fighter-bomber in so-called `sneak raids' over the southern coast 1942-44.
FZG 76	1944-45	-	Argus 109.014	2,180	Sheet steel, light alloy and plywood.	5,000+	16 (8)	Pilotless bomb, commonly known as the V1. Used in campaign against Britain June 1944 to March 1945. Carried 850kg warhead of HE. Ground and air launched.
Heinkel 111	1936-45	B	2x JJ 211 or 2x DB 601	8,680	All metal.	7,300	3 (1)	Main medium/heavy bomber from Spanish Civil War until end of WW2. From mid 1944 used to launch V1s.
Heinkel 177	1944-45	B, MR	2x DB 610	16,800	All metal.	1,169	0 (0)	Heavy bomber, made debut over England in January 1944 during the `Little Blitz'. Novel engine layout and unreliability caused constant problems.
Messerschmitt 210/410	1941-45	F,FB	2x DB 603	6,148	All metal.	352/ 1,121	1 (1)	Intended replacement for Me110, under-powered as day fighter and operated as night fighter over England 1943-45.
Heinkel 115	1936-45	ASR	2x BMW 312	6,700	All metal.	400+	1 (0)	Operated in MR and ASR role in UK coastal waters.
Junkers 86	1936-42	B, GR	2x JJ 207	6,700	All metal.	810-1,000	0 (0)	High altitude GR and B versions operated over southern England 1941-42.
Junkers 87	1937-45	B	JJ 211	3,900	All metal.	5,709	4 (1)	Dive-bomber. Successful in Poland and France, heavy losses in Battle of Britain. Withdrawn from NW Europe 1941 for use in

								Russia and Mediterranean.
Junkers 88	1939-45	B,NF	2x JJ213	11,000	All metal.	14,980	3 (1)	Multi-role aircraft. Used as bomber and dive-bomber in the Battle of Britain and became night fighter later in war.
Junkers 188	1943-45	B	2x JJ 213 or 2x BMW 801	?	All metal.	1,100	0 (0)	Operated over UK 1944 onwards as a night intruder.

Key to Appendices

Period of Service: total period of service with respective air force (as opposed to period of usage over the UK - see Notes column).

Role: the military role in which the aircraft was utilised (often not the role for which it was designed). AC=Army Co-operation, ASR=Air Sea Rescue, B=Bomber, Comms=Communications, F=Fighter, FB=Fighter Bomber, GR=General Reconnaissance, MR= Maritime Reconnaissance, NF=Night Fighter, RCM=Radio Countermeasures, TB= Torpedo Bomber, T=Trainer, TC=Troop Carrier, Trans=Transport, Tug=Glider/Target Tug

Power plant: AS=Armstrong Siddely, BF=Bramo Fafnir, DB=Daimler Benz, DH=De Haviland, JJ=Junkers Jumo,PW= Pratt and Whitney , RR=Rolls Royce

Weight: Total weight of airframe and engines, unloaded. Intended to give general indication of relative size.

Airframe Construction: Basic data on construction and major materials, where known.

Numbers: (1)=Total Produced, (2)=Number of complete airframes (ie. more than 66% intact) known to survive globally (inclusive of UK), figure in brackets = number surviving within UK. Global figures represent estimates, UK figures accurate and based upon 16th edition of Wrecks and Relics (Ellis 1998).

Notes: General information on background, importance and currency (ie. use within UK). In the case of British and Luftwaffe aircraft, intended to provide basis for the Scope Notes attached to NMR Thesaurus of Monument Types.

ANNEX THREE LIST OF 'KEY' SITES

The following list represents the military aviation sites from the pre-1945 period in England which retain the best-preserved airfield landscapes and/or most historically significant groups of original buildings.

Bicester

Oxfordshire

Bicester was built as a bomber station from 1924. It retains, better than any other aviation site in Britain, the layout and built fabric relating to both the first Expansion Period of the RAF and subsequent developments up to 1940. The grass airfield survives with airfield defences, bomb stores, perimeter track and some hardstandings added during the Second World War.

Biggin Hill

London Borough of Bromley

Britain's most celebrated fighter station. It retains a particularly fine officers' mess of 1934 and a good group of technical and domestic buildings (mostly 1930-34). The latter include the best-preserved married quarters group associated with a nationally-important site. The flying field, with later runways, retains defence posts and fighter pens from 1939.

Calshot

Hampshire

Opened in 1913, Calshot is the best-preserved of a chain of contemporary seaplane bases. The surviving group of hangars of 1913 – 18, now listed II*, exemplify the development of military aviation over this period in Britain.

Catterick

North Yorkshire

Originating as a Home Defence Station in 1914, Catterick is the best-preserved fighter sector station in the north of England. It retains a group of First World War hangars and Expansion Period buildings dating from the 1920s and 1930s. Fighter pens and defences were added around the airfield

at the beginning of the Second World War.

Cranwell

Lincolnshire

The development of the Cadet College at Cranwell, begun in 1929, was a cornerstone of Britain's independent airforce. College Hall (1929-33) and its formal setting form the most architecturally impressive set-piece designed for the RAF. Although best known for the Cadet College, Cranwell has in addition a long aviation history dating back to 1918.

Debden

Essex

Opened as a fighter station in 1937, Debden retains much of its 1930s character. It is also noted for the largely intact preservation of its flying field and defensive perimeter. Its historical importance largely resides in its role as one of the vital 11 Group sector stations during the Battle of Britain.

Dunkeswell

Devon

This is the best-preserved of all the sites in the west of Britain associated with the strategically-vital Battle of the Atlantic. Begun in 1941, the US Navy Fleet Air Wing was based here from 1942 until 1945. Dunkeswell exemplifies the highly dispersed planning and temporary fabric of contemporary airfields. Among the surviving original buildings are the operations block and control tower.

Duxford

Cambridgeshire

A famous fighter station noted for its Battle of Britain associations and later used as a USAAF fighter station. It retains the best-preserved technical fabric remaining from a site up to November 1918, including 3 paired hangars. The station was mostly rebuilt in the 1930s, with architecture representative of both expansion periods remarkably well preserved, and the airfield largely intact.

Farnborough

Hampshire

Farnborough is one of the key sites in Europe relating to the development of aviation technology and aeronautical research. Originating as the base for the Royal Engineers' School of Ballooning in 1906 and the Royal Engineers' Air Battalion from 1911, the site was later occupied by the Royal Aircraft Establishment. It closed as a military research establishment in 1999. Although much altered, the site retains a small number of historically significant buildings including two wind tunnels of 1934-5 and 1939-42.

Halton

Buckinghamshire

Halton was established as the centre for technical training for the Royal Flying Corps in 1917. After the First World War the site was developed to house the Aircraft Apprentice Scheme. The domestic site retains an extensive and well-preserved group of buildings from the 1920s and 1930s including the Groves and Henderson Barracks.

Henlow

Bedfordshire

The five General Service Sheds at Henlow comprise the most complete ensemble of hangar buildings on any British site for the period up to 1923. The domestic site retains an extensive group of married quarters, executed in the Garden City tradition, and barracks and office buildings dated 1933-5. These display unique architectural treatment for a military air base.

Hullavington

Wiltshire

Hullavington, which opened in 1937 as a Flying Training Station, embodies to a unique degree the improved architectural quality associated with the post–1934 Expansion Period of the RAF. Most of the original buildings have survived and form a particularly coherent and well-ordered ensemble. The flying field remains, bounded by groups of hangars.

Kenley

Greater London/Surrey

One of the key sector stations famous for its associations with the Battle of Britain. Although most of the original buildings have gone, the Officers' Mess and Institute buildings survive. These relate to a uniquely well-preserved airfield completed at the beginning of the Second World War, with runways, fighter pens and perimeter tracks.

Kemble

Gloucestershire/Wiltshire

Kemble is the most strongly representative - by virtue of its range of hangar types - of 24 Aircraft Storage Unit sites planned and built by the Air Ministry between 1936 and 1940. The hangars are dispersed in pairs around the airfield and include the most advanced Air Ministry hangar types of parabolic form and concrete construction.

Lee-on-Solent

(HMS Daedalus)

Hampshire

The best-preserved seaplane base in Britain, with three seaplane sheds of 1918 grouped around the original slipway. A major rebuilding took place after 1931 including the addition of a particularly fine officers' mess of 1934.

Manby

Lincolnshire

After Hullavington, the most complete and architecturally unified of the post-1934 Expansion Period stations in Britain. Both the technical and domestic buildings show a meticulous attention to layout and detail. The airfield is now in agricultural use.

Netheravon

Wiltshire

Begun in 1912, Netheravon is the most complete of the sites that relate to the

crucial formative phase in the development of military aviation in Europe, prior to the First World War. The domestic site retains a remarkably well-preserved group of single-storey barracks and mess buildings dating from 1913-14. The grass airfield remains intact.

Northolt

Greater London

Northolt was one of the 11 Group sector stations which played a significant operational role in the Battle of Britain. Although parts of the site have been subject to post-war redevelopment, most of the original buildings of the 1920s and '30s survive. Among these are the Officers' Mess, four barracks blocks, two hangars, the station workshops and the operations room. A fine memorial commemorates the contribution of Polish airmen to the Allied war effort.

North Luffenham

Rutland

Opened in 1940, North Luffenham is representative of the bomber bases built under Scheme M, retaining two J-type hangars as well as a coherent group of contemporary technical and domestic buildings. The runways, perimeter tracks and dispersals were added in 1944 and are one of the most complete landscapes of that period. The site was adapted in the Cold War period as a Thor IBM Headquarters with facilities for two Mark 1 Bloodhound Squadrons.

North Weald

Essex

Fighter sector station with Battle of Britain associations, and after Kenley and Debden retaining the best-preserved of the landscapes put in place by Fighter Command at the beginning of the Second World War.

Old Sarum

Wiltshire

The best-preserved flying field of the First World War period, bounded by

one of the most complete suites of technical and hangar buildings of the period.

Scampton

Lincolnshire

Opened in 1936 as a bomber station, Scampton's association with the Dambuster Raids make it Bomber Command's most famous base of the Second World War. It also played an important role in the Strategic Bomber Offensive and the daylight raids in support of the Allied offensive in Europe. It continued to evolve as a landscape for the projection of deterrent power against the Soviet Union in the Cold War period.

Upavon

Wiltshire

Founded in 1912 as the Royal Flying Corp's Central Flying School, Upavon comprises one of three sites around the Army training ground at Salisbury Plain which relate to the crucial formative phase in the development of military aviation in Europe, prior to the First World War. Several buildings of the 1913/14 period survive here among later development.

Uxbridge

Greater London

This site was developed as a major armaments training school at the end of the First World War and then as a recruit-training centre for the RAF in the 1920s. An impressive cinema building, barracks and other structures survive from this period. The site was developed in the grounds of Hillingdon House, which still stands. The underground bunker of 1938 contains the Group Operations Room from where the vital 11 Fighter Group was commanded during the Battle of Britain.

West Malling

Kent

A barracks square, officers' mess and control tower survive at one of the RAF's key front-line fighter stations, opened in 1940 and with a long and

distinguished wartime record.

Wroughton

Wiltshire

Opened in 1940, and after Kemble the best example of a landscape built as one of the Air Ministry's 24 Aircraft Storage Unit sites, with hangar types of parabolic form and concrete construction dispersed in groups around the flying field.